TMU 2020 PILOT

Teaching Mathematics for Understanding

GRADE 4

TERM 1

TRAINING OF TRAINERS HANDOUTS

CONTENTS

Agenda TMU 2020 Grade 4 Term 1

PLENARY SESSION : 21 January 2020				
SESSION	**TIME**	**MIN.**	**ACTIVITY**	**RESPONSIBILITY**
0	18H00 –19H30	90 min	Introduction of members Maths framework Maths Indaba TMU pilot Outlook of TMU pilot in Grade 4 2019 Pre-Post Test results	NECT Ingrid Sapire Ms Khembo NECT(Kondi) Asiya
DAY 1 :22 January 2020				
	07H45 –08H00		Registration	Nokuthabo & Asiya
1	08H00 –08H45	45 min	**Pre-training Activity (pre-test)**	MQA Team
2	08H45 –09H00	15 min	Welcome, ground rules and housekeeping	Facilitators (Cebisa)
3	09H00–10H00	60 min	Implication of the framework on CAPS Reorganised CAPS for Grade 4	Facilitators (Cebisa & Junko)
10H00–10H30				
4	10H30 –11H30	60 min	Material distribution **TMU Resources :** • Lesson Plans with Planners & Tracker • Learner Activity Book (LAB) • Teacher Resource & printables • Bilingual Dictionary in 6 languages Introduction of TMU resources	Facilitators (Jackie)
5	11H30 –12H15	45 min	Having a look at TMU resources Q & A • Perspectives and expectation of TMU pilot from participants	Participants
6	12H15 –13H00	45/105 min	Introduction of TMU approaches GR 4 Revision Programme for the first 2 weeks.	Facilitators (Junko)
13H00 –13H45				
6	13H45 –14H45	60/105 min	continued	
7	14H45 –15H45	60 min	**Content input1 (Slides)** Unit 1: large numbers up to 1 000 000	Facilitators (Jackie with Junko)
15H45 –16H15				
8	16H15 –17H30	75 min	Dry run preparation – Unit 1 lessons 5 and 10	Facilitators

DAY TWO: 23 January 2020				
	TIME	**MIN.**	**ACTIVITY**	**SPEAKER**
9	08H00 –09H00	60 min	**Content input 2 (Slides)** Unit 2: Base ten kit and simplifies pictorial as strategies for addition and subtraction	Facilitators (Jackie with Junko)
10	09H00 –10H00	60 min	Dry run preparation – Unit 2 lessons 17 and 20	Facilitators
10H00–10H30				
11	10H30 –11H30	60 min	**Content input 3 (Slides)** Unit 3: Rounding off	Facilitators (Jackie)
12	11H30 –12H30	60 min	Dry run preparation – Unit 3 lessons Week 5 Lesson 4 and Week 6 Lesson 2	Facilitators
12H30 –13H15				
13	13H15 –14H30	75 min	**Content input 4 (Slides)** Unit 4: Numeric pattern and equations	Facilitators (Jackie)
14	14H30 –15H30	60 min	Dry run preparation – Unit 4 lessons Week 7 Lesson 4 and Week 8 Lesson 4	Facilitators
15H30 –16H00				
15	16H00 –16H45	45 min	Preparation of teacher training	Facilitators
16	16H45–18H30	105 min	Finalising all dry run preparation	Facilitators

DAY THREE: 24 January 2020				
	TIME		**ACTIVITY**	**SPEAKER**
17	08H00 –09H10	70 min	Dry run presentation Unit 1: Lessons 5 and 9	Participants
	09H10 –10H20	70 min	Dry run presentation Unit 2: Lessons 17 and 20	Participants
10H20 –10H50 TEA				
18	10H50 –12H00	70 min	Dry run presentation Unit 3: Week 6 Lesson 2 Unit 4: Week 7 Lesson 4	Participants
19	12H00 –12H45	45 min	**Post training activity (post-test)**	MQA Team
20	12H45 –13H00	15 min	Evaluation and closure	MQA Team Facilitators
13H00 –14H00 LUNCH				

Materials Distribution Form

Please take time to:

- check off each item as you receive it.
- write your name on each item that you are given.
- keep all your materials together.

Remember to look after these resources.

For example:

a. Try to stick flashcards on cardboard, and laminate them.
b. Store lesson plans carefully, so they do not fall apart and get ruined.

If you leave the school or change grades, please pass the relevant resources on to the next teacher.

2020TERM	GRADE	ITEM	CHECK
1	4	LESSON PLAN	
1	4	TEACHER RESOURCE PACK	
1	4	LEARNER ACTIVITY BOOK (LAB)	
1	4	REVISION PROGRAMME	
1	1-3	BILINGUAL DICTIONARY	

PILOT participation

CURRENT EXPERIENCE WITH GRADE 4 MATHEMATICS TEACHING

CONCERNS ABOUT THE TMU PILOT

WHAT I HOPE TO GET OUT OF THE TMU PILOT

Lesson plan adaptation to the Mathematics Framework

General Adaptation to align with the Mathematics Framework

- The framework calls for **Teaching Mathematics for Understanding** (TMU)
- The framework suggests that there should be a balance of conceptual, procedural, strategies and reasoning, in a learning centred classroom.

The framework dimensions were well represented in the lesson plans you have already been provided with – but the balance of the dimensions can always be improved. The new lesson plans include improved and changed activities, more scaffolding in some activities and more notes to help teachers teach in a way that is aligned to the Mathematics Framework.

The framework also suggests that the vertical algorithm should be one of the algorithms that teachers are allowed to teach. This was not present in the previous lesson plans as it was not explicitly in the CAPS. This is a significant change in both the Foundation Phase and the Intermediate Phase. All algorithms should be taught by building on concepts. But alternative algorithms are not left out – they are all part of the curriculum.

The framework also calls for a reorganisation of the CAPS in order to allow for greater depth of teaching. Thus the sequencing of the lessons has changed. The sequencing of the reorganised CAPS has been developed for the TMU PILOT by JICA at the DBE. This curriculum strengthening is a critical element of the TMU PILOT which has come about as a result of the framework.

TMU PILOT materials

These consist of:

1. Lesson Plans with unit planner– including revision lessons for the first two weeks.
2. A teacher resource pack (lesson handouts, flashcards and assessment tasks).
3. Learner Activity Books (daily classwork and homework activities – LAB).
4. Bilingual dictionaries (composite Grade 1-2-3 word list with explanations, examples and illustrations).

Adaptations were made to these components of the lesson plans

- Lesson plan outline (see adaptations in Lesson Plan document front pages)
- Design of lesson plan:
    - UNIT Introduction provided per unit
    - **Links to the Mathematics Framework – Teaching Mathematics for Understanding.**
    - Fully planned lessons
    - Consolidation lessons
    - Assessment Tasks
    - Printable versions of assessments provided in the Teacher Resources.
- **Timing of lesson components (adapted):** For best use of the 60-minute lesson – the following was agreed.
    - Mental maths (5 minutes)
    - Link to previous lesson (5 minutes)
    - Homework correction (5 minutes)
    - Lesson content – concept development and Classwork activity (35 minutes)
    - Homework activity (5 minutes)

        - Reflection and summary of lesson (5 minutes)

- Simplified Unit Plan and Overview – This provides opportunities to keep a record of work and to reflect on work done.

TMU PILOT Methodology

Conceptual understanding is one of the most critical ideas that teachers have to build in learners. The content input in this training session is intended to introduce the following methodologies that contribute to the conceptual understanding of mathematics.

1. CPA approach
2. Base ten number system with place value table
3. Word problems with diagrams
4. Addition and subtraction in column

'CPA approach' stands for a **concrete-pictorial-abstract** approach. It helps Grade 4 learners to make connections between concrete objects to number symbols and number sentences. This is a key for bringing up number sense. It is not a linear process – learners go between the three levels of activities forwards and backwards, sometimes many times, before the final consolidation of abstract understanding.

Using diagrams in word problem helps learners understand the question and work out an operation to find the solution to the problem.

See **Lesson Plan** inserts for details on the TMU PILOT methodology and vocabulary.

Lesson Demonstrations

- Take note of the lesson that has been assigned to you for demonstration.
- Read the lesson plan (not only the lesson you demonstrate, but also the previous and the following lesson plans to see the progression) and the core methodology to help you prepare your lesson.
- Remember to pay close attention to your time management and incorporate good classroom management strategies.
- Do not do too much speaking – give concise, clear instructions and explanations.
- Take care to use the concrete materials in the appropriate way and give time to learners to manipulate the materials as well. Allow the learners time to explain what they are doing.
- Give time to learners to write down their work in their classwork books as well, especially since it is the first time for many of Grade 4 learners to learn mathematics in English.

Unit	Lesson no	Lesson content	Time Allocation	Presenters
1	5	Order, Compare and represent numbers	25 minutes	
1	10	Dividing by 10, 100, 1 000	25 minutes	
2	17	Using the column method to subtract 5-digit numbers	25 minutes	
2	20	Using other methods to subtract big numbers	25 minutes	
3	28	Using rounded numbers	25 minutes	
3	32	Approximation by grouping	25 minutes	
4	40	Geometric patterns, tables and flow diagrams (1)	25 minutes	
4	46	More number sentences (2)	25 minutes	

Teaching in multilingual contexts

Please discuss the following questions. Think about examples from the classroom that are relevant as well.

1. Do you feel comfortable teaching mathematics in English?
2. What is your view on the language policy for Grade 4?
3. What do you think the LoLT for mathematics should be? From Grade 1 (HL/English?)
4. What do you do when you see that the learners don't understand what you are saying? (explain/use concrete material/other?)
5. Have you noticed language inconsistencies in textbooks/DBE workbook/CAPS?
6. Did your learners experience any problems with regard to vocabulary when the learners wrote the ANA? (specific examples/general).
7. How do you use code-switching or translanguaging strategies in your teaching?

Specification of Content (Grade overview)

NUMBERS, OPERATIONS AND RELATIONSHIP			
TOPIC	**CONCEPTS AND SKILLS**	**CAPS**	**NEW/ EXTENSION**
Whole numbers	**Mental calculations involving**: • Addition and subtraction of: – units – multiples of 10 – multiples of 100 – multiples of 1 000 – multiples of 10 000 – multiples of 100 000 • Multiplication of whole numbers to at least 10 x 10 • Multiplication facts of: – units by multiples of 10 – units by multiples of 100 – units by multiples of 1000 – units by multiples of 10 000 – units by multiples of 100 000 **Number range for counting, ordering, comparing and representing, and place value of digits** • Count forwards and backwards in 2s, 3s, 5s, 10s, 25s, 50s, 100s, 1 000s, 10 000s and 100 000s between 0 and at least 1 000 000. • Order, compare and represent numbers to at least 6-digit numbers • Represent odd and even numbers to at least 1 000 000. • Recognize the place value of digits in whole numbers to at least 6-digit numbers • Round off to the nearest 10, 100, 1 000, 10 000, 100 000	**Mental calculations involving**: • Addition and subtraction of up to multiples of 1000: • Multiplication facts of units by multiples up to 1 000: **Number range for counting, ordering, comparing and representing, and place value of digits** • Count forwards and backwards in 2s, 3s, 5s, 10s, 25s, 50s, 100s, between 0 and at least 10 000 • Order, compare and represent numbers to at least 4-digit numbers • Represent odd and even numbers to at least 1 000. • Recognize the place value of digits in whole numbers to at least 4-digit numbers • Round off to the nearest 10, 100, 1 000	**Mental calculations involving**: • Addition and subtraction of: – multiples of 10 000 – multiples of 100 000 • Multiplication facts of: – units by multiples of 10 000 – units by multiples of 100 000 **Number range for counting, ordering, comparing and representing, and place value of digits** • Count forwards and backwards in 1 000s, 10 000s and 100 000s between 0 and at least 1 000 000. • Order, compare and represent numbers to at least 6-digit numbers • Represent odd and even numbers to at least 1 000 000. • Recognize the place value of digits in whole numbers to at least 6-digit numbers • Round off to the nearest 10 000, 100 000

	Number range for calculations • Addition and subtraction of whole numbers of at least 6 digits • Multiplication of at least whole 2-digit by 2-digit numbers • Division of at least whole 3-digit by 1-digit numbers **Calculation techniques** • Use a range of techniques to perform and check written and mental calculations of whole numbers including: – estimation – adding, subtracting and multiplying in columns – long division – building up and breaking down numbers – rounding off and compensating – doubling and halving – using a number line – using addition and subtraction as inverse operations – using multiplication and division as inverse operations	**Number range for calculations** • Addition and subtraction of whole numbers of at least 4 digits • Multiplication of at least whole 2-digit by 2-digit numbers • Division of at least whole 3-digit by 1-digit numbers **Calculation techniques** • Use a range of techniques to perform and check written and mental calculations of whole numbers including: – estimation – building up and breaking down numbers – rounding off and compensating – doubling and halving – using a number line – using addition and subtraction as inverse operations – using multiplication and division as inverse operations	**Number range for calculations** • Addition and subtraction of whole numbers of at least 6 digits **Calculation techniques** • Use a range of techniques to perform and check written and mental calculations of whole numbers including: – Adding, subtracting and multiplying in columns – long division

TOPIC	CONCEPTS AND SKILLS	CAPS	NEW/ EXTENSION
Whole numbers	**Number range for multiples and factors** • Multiples of 1-digit numbers to at least 100 **Properties of whole numbers** • Recognize and use the commutative, associative, and distributive properties with whole numbers • 0 in terms of its additive property • 1 in terms of its multiplicative property **Solving problems** • Solve problems in contexts involving whole numbers, including – financial contexts – measurement contexts • Solve problems involving whole numbers, including – comparing two or more quantities of the same kind (ratio) – comparing two quantities of different kinds (rate) – grouping and equal sharing with remainders	**Number range for multiples and factors** • Multiples of 1-digit numbers to at least 100 **Properties of whole numbers** • Recognize and use the commutative, associative, and distributive properties with whole numbers **Solving problems** • Solve problems in contexts involving whole numbers, including – financial contexts – measurement contexts • Solve problems involving whole numbers, including – comparing two or more quantities of the same kind (ratio) – comparing two quantities of different kinds (rate) – grouping and equal sharing with remainders	**Properties of whole numbers** • 0 in terms of its additive property (was lifted in clarification notes) • 1 in terms of its multiplicative property
Common fractions	**Describing and ordering fractions:** • Compare and order common fractions and mixed numbers (halves; thirds, quarters; fifths; sixths; sevenths; eighths; tenths), where a denominator is a multiple of another. • Describe and compare common fractions in diagram form **Calculations with fractions:** • Addition and subtraction of common fractions and mixed numbers with the same denominators • Recognize, describe and use the equivalence of division and fractions **Solving problems** • Solve problems in contexts involving fractions,	**Describing and ordering fractions:** • Compare and order common with different denominators (halves; thirds, quarters; fifths; sixths; sevenths; eighths; tenths) • Describe and compare common fractions in diagram form **Calculations with fractions:** • Addition of common fractions with the same denominators • Recognize, describe and use the equivalence of division and fractions **Solving problems** • Solve problems in contexts involving fractions,	**Describing and ordering fractions:** • Compare and order mixed numbers (tenths), where a denominator is a multiple of another. **Calculations with fractions:** • Addition and subtraction of mixed numbers with the same denominators

	including grouping and equal sharing **Equivalent forms:** • Recognize and use equivalent forms of common fractions (fractions in which one denominator is a multiple of another)	including grouping and equal sharing **Equivalent forms:** Recognize and use equivalent forms of common fractions (fractions in which one denominator is a multiple of another)	 **Equivalent forms:** N/A
Decimal fractions	**Recognizing, ordering and place value of decimal fractions** • Count forwards and backwards in decimal fractions to at least one decimal place • Compare and order decimal fractions to at least one decimal place • Place value of digits to at least one decimal place **Calculations with decimal fractions** • Addition and subtraction of decimal fractions with at least one decimal place • Multiply decimal fractions by 10 **Solving problems** • Solve problems in context involving decimal fractions **Equivalent forms**: • Recognize equivalence between common fraction and decimal fraction forms of the same number where the denominator is a factor of 10	N/A	Everything on decimals

PATTERNS, FUNCTIONS AND ALGEBRA			
TOPIC	**CONCEPTS AND SKILLS**	**CAPS**	**NEW/ EXTENSION**
Numeric patterns	**Investigate and extend Numeric patterns** • Investigate and extend numeric patterns – involving a constant difference – of learners own creation • Describe observed relationship or rules in own words or by number sentence **Input and output values** • Determine the input and output values given rules in – flow diagram – tables • Determine the rule given input and output values in flow diagrams **Equivalent forms** • Determine equivalence of different descriptions of the same relationship or rule presented: – verbally – in a flow diagram – in a table – by a number sentence	**Investigate and extend Numeric patterns** • Investigate and extend numeric patterns – involving a constant difference – of learners own creation • Describe observed relationship or rules in own words or by number sentence **Input and output values** • Determine the input and output values given rules in – flow diagram – tables • Determine the rule given input and output values in flow diagrams **Equivalent forms** • Determine equivalence of different descriptions of the same relationship or rule presented: – verbally – in a flow diagram – in a table – by a number sentence	N/A

Geometric patterns	**Investigate and extend geometric patterns** • Investigate and extend numeric patterns – represented in physical or diagram form – not limited to a constant difference – of learners own creation • Describe observed relationship of the above patterns in own words • Describe observed rules of patterns involving constant difference in own words or by number sentence **Input and output values** • Determine the input and output values given rules in – flow diagram – tables • Determine the rule given input and output values in flow diagrams and tables **Equivalent forms** • Determine equivalence of different descriptions of the <u>same relationship or rule</u> presented – verbally – in a flow diagram – in a table – by a number sentence	**Investigate and extend geometric patterns** • Investigate and extend numeric patterns – represented in physical or diagram form – not limited to a constant difference – of learners own creation • Describe observed relationship or rules in learner's own words **Input and output values** • Determine the input and output values given rules in – flow diagram – tables • Determine the rule given input and output values in flow diagrams **Equivalent forms** • Determine equivalence of different descriptions of the <u>same relationship or rule</u> presented – verbally – in a flow diagram – by a number sentence	**Investigate and extend geometric patterns** • Describe observed rules of patterns involving constant difference in own words or by number sentence **Input and output values** • Determine the rule given input and output values in flow diagrams and tables **Equivalent forms** • Determine equivalence of different descriptions of the <u>same relationship or rule</u> presented – in a table

<table>
<tr><th>TOPIC</th><th>CONCEPTS AND SKILLS</th><th>CAPS</th><th>NEW/ EXTENSION</th></tr>
<tr><td>Number sentence</td><td>Patterns with number bonds
• Addition and subtraction with number bonds for multiples of 10, 100, 1000 and 10 000
• Multiplication facts of whole numbers by 10, 100, and 1 000
• Division facts of whole numbers by 10, 100 and 1 000 resulting to whole numbers

Solving problems
• Solve and complete number sentence by inspection using the following
– Properties of whole numbers
✓ Commutative, associative and distributive property
✓ Identity element of 0
✓ Identity element of 1
– inverse operations
✓ Addition and subtraction
✓ Multiplication and division

• Solve and complete number sentence by
– trial and improvement
– substitution

Describing a problem situation
• Write number sentence to describe problem situation</td><td>Patterns with number bonds
• Addition and subtraction with number bonds for multiples of 10, 100 and 1000

Solving problems
• Solve and complete number sentence by inspection using the following
– Properties of whole numbers
✓ Commutative, associative and distributive property

– inverse operations
✓ Add Addition and subtraction
✓ Multiplication and division

• Solve and complete number sentence by
– trial and improvement
– substitution

Describing a problem situation
Write number sentence to describe problem situation</td><td>Patterns with number bonds
• Addition and subtraction with number bonds for multiples of 10 000
• Multiplication facts of whole numbers by 10, 100, and 1 000
• Division facts of whole numbers by 10, 100 and 1 000 resulting to whole numbers

Solving problems
• Solve and complete number sentence by inspection using the following
– Properties of whole numbers
✓ Identity element of 0
✓ Identity element of 1</td></tr>
</table>

SPACE AND SHAPE			
TOPIC	**CONCEPTS AND SKILLS**	**CAPS**	**NEW/ EXTENSION**
Properties of 2-D shapes	**Range of shapes** • Recognize, visualize and name 2-D shapes in the environment and geometric settings – regular and irregular polygons – right triangles, triangles, squares, rectangles, other quadrilaterals, pentagons, hexagons – circles **Characteristics of shapes** • Describe, sort and compare 2-D shapes in terms of – straight and curved sides – number of sides – lengths of sides – angles in shapes, limited to right angles **Further activities** • Draw squares, rectangles and right triangles on a grid paper	**Range of shapes** • Recognize, visualize and name 2-D shapes in the environment and geometric settings – regular and irregular polygons, triangles, squares, rectangles, other quadrilaterals, pentagons, hexagons – circles **Characteristics of shapes** • Describe, sort and compare 2-D shapes in terms of – straight and curved sides – number of sides **Further activities** Draw 2-D shapes on a grid paper	**Range of shapes** • Recognize, visualize and name 2-D shapes in the environment and geometric settings – regular and irregular polygons – right triangles, **Characteristics of shapes** • Describe, sort and compare 2-D shapes in terms of – lengths of sides – angles in shapes, limited to right angles **Further activities** Draw squares, rectangles and right triangles on a grid paper
Properties of 3-D objects	**Range of objects** • Recognize, visualize and name 3-D objects in the environment and geometric settings, focusing on: – rectangular prisms, – spheres – cylinders – pyramids **characteristics of objects** • Describe, sort and compare 3-D objects in terms of – shapes of faces – flat and curved surfaces **Further activities** • Make 3-D models using cut out polygons	**Range of objects** • Recognize, visualize and name 3-D objects in the environment and geometric settings, focusing on: – rectangular prisms, – spheres – cylinders – pyramids **characteristics of objects** • Describe, sort and compare 3-D objects in terms of – shapes of faces – flat and curved surfaces **Further activities** Make 3-D models using cut out polygons	N/A
Symmetry	**Symmetry** • Recognize, draw and describe line(s) of symmetry in 2-D shapes	**Symmetry** Recognize, draw and describe line(s) of symmetry in 2-D shapes	Done as early as FP

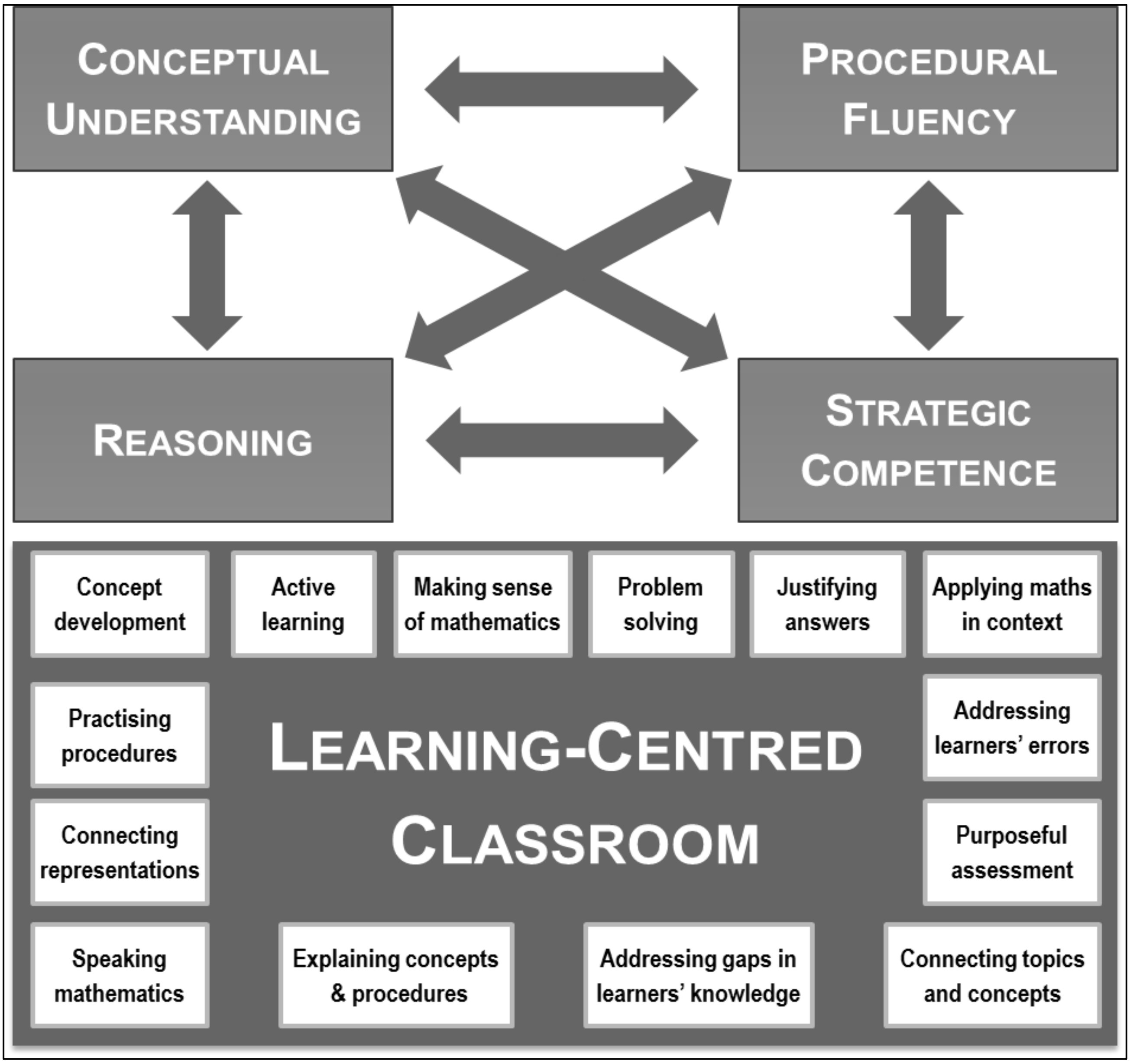
TOPIC	CONCEPTS AND SKILLS	CAPS	NEW/ EXTENSION
Transformation	**Build composite shapes** • Put 2-D shapes together to make different composite 2-D shapes including some shapes with line symmetry. **Tessellations** • Pack out 2-D shapes to make tessellated patterns including some patterns with line symmetry. **Describe patterns (Revision)** • Refer to lines, 2-D shapes, 3-D objects and lines of symmetry when describing patterns – in nature – from modern everyday life – our cultural heritage	**Build composite shapes** • Put 2-D shapes together to make different composite 2-D shapes including some shapes with line symmetry. **Tessellations** • Pack out 2-D shapes to make tessellated patterns including some patterns with line symmetry. **Describe patterns** • Refer to lines, 2-D shapes, 3-D objects and lines of symmetry when describing patterns – in nature – from modern everyday life – our cultural heritage	N/A N/A N/A, but this is done as early as FP
Viewing objects	**Position and views** • Match different views of everyday objects • Identify everyday objects from different views	**Position and views** • Match different views of everyday objects • Identify everyday objects from different views	N/A
Position and movement	**Location and directions** • Locate position of objects, drawings or symbols on a grid with alpha-numeric grid references • Locate positions of objects on a map by using alpha-numeric grid references	**Location and directions** • Locate position of objects, drawings or symbols on a grid with alpha-numeric grid references • Locate positions of objects on a map by using alpha-numeric grid references	N/A

MEASUREMENT			
TOPIC	**CONCEPTS AND SKILLS**	**CAPS**	**NEW/ EXTENSION**
Length	**Measurement, instruments and units** • Estimate the length of 2-D shapes and 3-D objects • Practically measure the length of 2-D shapes and 3-D objects using measuring instruments such as rulers, metre sticks, tape measures, trundle wheels • Record the length of the above in **units of length:** millimetres (*mm*), centimetres (*cm*), metres (*m*), kilometres (*km*) **Calculations and problem-solving involving length** • Solve problems in contexts related to length involving • conversions include converting between: - *mm* and *cm* - *cm* and *m* - *m* and *km* N.B Conversions are limited to whole numbers, fractions and decimal fractions to one decimal place	**Measurement, instruments and units** • Estimate the length of 2-D shapes and 3-D objects • Practically measure the length of 2-D shapes and 3-D objects using measuring instruments such as rulers, metre sticks, tape measures, trundle wheels • Record the length of the above in **units of length:** millimetres (*mm*), centimetres (*cm*), metres (*m*), kilometres (*km*) **Calculations and problem-solving involving length** • Solve problems in contexts related to length involving • conversions include converting between: - *mm* and *cm* - *cm* and *m* - *m* and *km* N.B Conversions are limited to whole numbers and common fractions	**Measurement, instruments and units** **N/A** **Calculations and problem-solving involving length** N.B Conversions are limited to whole numbers, fractions and decimal fractions to one decimal place
Mass	**Measurement, instruments and units** • Estimate the mass of 3-D objects • Practically measure the mass of 3-D objects using measuring instruments such as bathroom scales, kitchen scales and balances • Record the mass of the above in **units of mass:** grams (g) and kilograms (kg); **Calculations and problem-solving involving mass include** • problems in contexts • converting between grams and kilograms limited to examples with whole numbers, fractions and decimal fractions to one decimal place	**Measurement, instruments and units** • Estimate the mass of 3-D objects • Practically measure the mass of 3-D objects using measuring instruments such as bathroom scales, kitchen scales and balances • Record the mass of the above in **units of mass:** grams (g) and kilograms (kg); **Calculations and problem-solving involving mass include** • problems in contexts • converting between grams and kilograms limited to examples with whole numbers and common fractions	**Measurement, instruments and units** **N/A** **Calculations and problem-solving involving mass include** • converting between grams and kilograms limited to examples with whole numbers, fractions and decimal fractions to one decimal place

TOPIC	CONCEPTS AND SKILLS	CAPS	NEW/ EXTENSION
Capacity/ volume	**Measurement, instruments and units** • Estimate the capacity/volume of 3-D objects • Practically measure the capacity/volume of objects using measuring instruments such as measuring spoons, measuring cups, measuring jugs • Record the capacity/volume of the above in **units of mass:** millilitres (*ml*) and litres (*l*) **Calculations and problem-solving involving capacity/volume include** • problems in contexts • converting between millilitres (*ml*) and litres (*l*) limited to examples with whole numbers, fractions and decimal fractions to one decimal place	**Measurement, instruments and units** • Estimate the capacity/volume of 3-D objects • Practically measure the capacity/volume of objects using measuring instruments such as measuring spoons, measuring cups, measuring jugs • Record the capacity/volume of the above in **units of mass:** millilitres (*ml*) and litres (*l*) **Calculations and problem-solving involving capacity/volume include** • problems in contexts • converting between millilitres (*ml*) and litres (*l*) limited to examples with whole numbers and common fractions	**Measurement, instruments and units** • N/A **Calculations and problem-solving involving capacity/volume include** • converting between millilitres (*ml*) and litres (*l*) limited to examples with whole numbers, fractions and decimal fractions to one decimal place
Area and Perimeter and volume of solids	**Perimeter** Calculate the perimeter of regular and irregular shapes by adding the lengths of the sides. **Measurement of area** Calculate the area of squares and rectangles **Measurement of volume** Calculate the volume of simple solid objects	**Perimeter** Measure perimeter using rulers or measuring tapes **Measurement of area** • Find areas of regular and irregular shapes by counting squares on grids in order to develop an understanding of square units **Measurement of volume** • Find volume/capacity of objects by packing or filling them in order to develop an understanding of cubic units	**Perimeter** N/A **Measurement of area** Calculate the area of squares and rectangles **Measurement of volume** Calculate the volume of simple solid objects
Time	**Reading time and time instruments** • Read, tell and write time in 12-hour and 24-hour formats on both analogue and digital instruments in - hours - minutes - seconds • Instruments include clocks and watches **Reading calendars** **Calculations and problem solving time include** • problems in contexts involving time • calculation of the number of days between any two dates within the same or consecutive years • calculation of time intervals where time is given in minutes or hours only **History of time** Know some ways in which time was measured and represented in the past	**Reading time and time instruments** • Read, tell and write time in 12-hour and 24-hour formats on both analogue and digital instruments in - hours - minutes - seconds • Instruments include clocks and watches **Reading calendars** **Calculations and problem solving time include** • problems in contexts involving time • calculation of the number of days between any two dates within the same or consecutive years • calculation of time intervals where time is given in minutes or hours only **History of time** Know some ways in which time was measured and represented in the past	N/A

DATA HANDLING			
TOPIC	**CONCEPTS AND SKILLS**	**CAPS**	**NEW/ EXTENSION**
5.1 Collecting and Organising data	**Collecting and organising data** • Collect data using tally marks and tables for recording	**Collecting and organising data** • Collect data using tally marks and tables for recording	N/A
5.2 Representing data	**Representing data** • Draw a variety of graphs to display and interpret data including: - pictographs (many-to-one correspondence) between data and representation) - bar graphs	**Representing data** • Draw a variety of graphs to display and interpret data including: - pictographs (one-to-one correspondence between data and representation) - bar graphs	**Representing data** • Draw a variety of graphs to display and interpret data including: - pictographs (many-to-one correspondence) between data and representation)
5.3 Analysing, Interpreting and Reporting data	**Interpreting data** • Critically read and interpret data represented in - words - pictographs - bar graphs - pie charts **Analysing data** Analyse data by answering questions related to data categories **Reporting data** Summarise data verbally and in short written paragraphs	**Interpreting data** • Critically read and interpret data represented in - words - pictographs - bar graphs - pie charts **Analysing data** Analyse data by answering questions related to data categories **Reporting data** Summarise data verbally and in short written paragraphs	N/A
5.4 Probability	N/A	**Probability experiments** • Perform simple repeated events and list possible outcomes for experiments such as: - tossing a coin - rolling a die	Delay in teaching probability

Mathematics Teaching and Learning Framework



A: TEACHING MATHS FOR CONCEPTUAL UNDERSTANDING
(Maths Teaching and Learning Framework p. 15)

Conceptual knowledge is knowledge of concepts, relations, and patterns. It assists and enables learners to make se of mathematics. Learners who have a sound grasp of conceptual knowledge, when asked to justify their work, would say, 'My teacher told me to do it like this' rather they will be able to explain the reasoning behind their work.

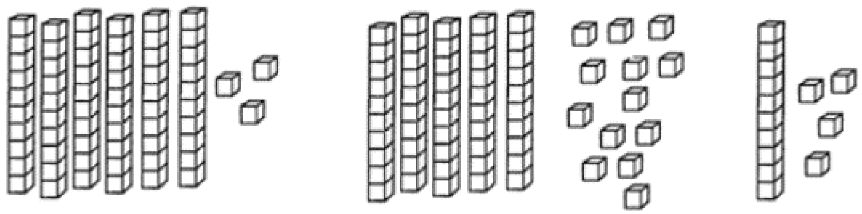
Learners who have conceptual knowledge are able to compare, relate and infer. They can make connections betw ideas. Higher level thinking is fundamental to conceptual knowledge. Conceptual knowledge is constructed as proble are solved, investigations are carried out, and questions are pondered. Meanings and connections among ideas deve as learners work with concrete, pictorial, and symbolic material, as they reflect on what they have done, and as t communicate with others. However, learners often need teachers to thoughtfully and strategically push them to progr from concrete, specific working to more abstract generalised ideas. The more the learners are exposed to such way working, the better the chances become that they will develop into mathematical problem solvers.

When a new concept is introduced to learners, the teacher should plan a lesson for conceptual development. T process places considerable pedagogic demands on the teacher. All introductory lessons should be carefully plann Learners could be engaged by sharing their ways of thinking and the teacher should use these ideas to challe learners to construct and connect ideas through reflective discussions on the methods.

Teachers might choose to use appropriate manipulatives and bring in aspects of learners' out of school experience order to help learners to build their knowledge.

For example, a learner finding the difference between two 2-digit numbers could be shown how the calculation wo using base ten blocks. The concept of subtraction, which was introduced in Grade 1 is reinforced in this Grad example, by the concrete demonstration, which can be linked to a numeric calculation to help the learner make connection between concrete working and abstract calculations.

63 – 49 =



Lay out 63 using base ten blocks | Exchange one ten for ten ones | 14 remains after subtracing 49

I have 6 tens and 3 ones from which I must subtract 49.	I have 5 tens and 13 ones after I exchange in order to be able to subtract.	If I take away 4 tens and 9 ones, I have 1 ten and 4 ones left, that is 14 left.

The concrete working with base ten blocks shown above demonstrates the exchange needed in order to do subtraction. This concrete activity builds up learners' conceptual understanding of number and operations. The writ record of the procedure is based on conceptual knowledge. Learners need connections to be made explicit in orde become fluent in the use of procedures.

1. What is conceptual knowledge? Write a short definition / description.

   Conceptual knowledge is knowledge of concepts, relations and patterns. Conceptual knowledge assists and enables learners to make sense of maths. Learners who have conceptual knowledge are able to explain the reasoning behind their work.

2. What are learners who have conceptual knowledge able to do?

Learners with conceptual knowledge are able to compare, relate (show connections between things) and infer (conclude from the given information)

3. How is concept knowledge constructed?

   Conceptual knowledge is constructed as problems are solved, investigations are carried out and questions are pondered (thought about).

4. How are meanings and connections among ideas develop?

   Meanings and connections among ideas develop as learners work with the concrete (actual Base 10 blocks), the pictorial (pictures of Base 10 blocks) and the symbolic (written calculations); as they reflect on what they have done; as they communicate with others. The more the learners are exposed to such ways of working, the better the chances become that they will develop into mathematical problem solvers.

5. What should teachers plan for when introducing a new concept to learners?

   When introducing a new concept to the learners, the teacher should always plan an introductory lesson which allows for conceptual development. Teachers should use the learners' ways of thinking to encourage the learners to construct and connect ideas through reflective discussions (where learners are encouraged to think and talk about the methods).

6. In the example given where the learners have to subtract 49 from 63, what conceptual knowledge is being developed?

   Learners in the higher grades often struggle when having to "borrow" when subtracting. Allowing the learners to develop an understanding that larger numbers are being exchanged or broken up in order to assist with the subtraction will assist the learners conceptual understanding of subtracting with "borrowing".

B: TEACHING MATHS FOR PROCEDURAL FLUENCY
(Maths Teaching and Learning Framework p. 16)

Whereas conceptual understanding is an implicit or explicit understanding of the interrelations between pieces knowledge, procedural knowledge is seen as the sequence of actions that are performed to solve a problem. The two types of knowledge do not develop independently. Conceptual understanding often leads into the procedures tha learner will use. Often conceptual understanding precedes procedural skills. A teacher who is aware of the importan of conceptual understanding when teaching concepts will not teach the procedural skills before learners have master the concepts involved.

Procedural knowledge is the recognition of symbols and the ability to follow rules to 'do' mathematics. It can be thoug of as having mathematical skills and carrying out actions in a correct sequence. Mathematical expertise involves bo conceptual and procedural knowledge and also awareness that procedures are based on mathematical principle Conceptual and procedural knowledge support each other and work together to attain mathematical power. Procedur connected to conceptual knowledge give flexibility to mathematical thinking and enable learners to extend the range both types of knowledge when new problems arise. If children learn procedures without understanding, their knowled may be limited to meaningless routines.

Research has shown that increasing learners' conceptual knowledge leads to the ability to generate one's o procedures. There is a reciprocal relationship between conceptual and procedural knowledge, but as argued abo conceptual knowledge has a stronger and more foundational role to play in developing procedural knowledge than t reverse. Conceptual understanding leads to the generation of flexible procedures, and procedural knowledge can le to conceptual understanding. Similarly conceptual teaching (teaching focused on developing conceptual understandir enables the effective teaching of flexible procedures and these procedures then enables strengthened engagement w conceptual understanding in one's teaching.

Developing procedural fluencies for adding and subtracting numbers is essential for further mathematical learning. Fluency is developed through much repetition and practice.

For example, a teacher could teach learners how to use the vertical algorithm when teaching addition and subtraction (the additive relations). The vertical method of recording working with numbers links to the number system that we use and can be explained using place value. It is an efficient and effective procedure that has been used for many years. Correct working with vertical algorithms builds on and develops learners' number sense but only if learners understand why the 6 becomes 5 and the 3 becomes 13 in the steps used.

$63 - 49 = \square$

$$\begin{array}{rcc} & {\scriptstyle 5} & {\scriptstyle 13} \\ & \cancel{6} & \cancel{3} \\ - & 4 & 9 \\ \hline & 1 & 4 \end{array}$$

1. What is a procedure in maths? Give an example of a procedure.

   A procedure is a way of doing something. An algorithm is a procedure. The addition algorithm is the procedure that we use when adding numbers vertically.

2. What is procedural knowledge? Write a short definition / description.

   Procedural knowledge is the recognition of symbols and the ability to follow rules to 'do' mathematics. It can be thought of as having mathematical skills and carrying out actions in a correct sequence.

3. Generally, which comes first: conceptual understanding or procedural fluency?

These two types of knowledge do not develop independently. Conceptual understanding often leads into the procedures that a learner will use. Often conceptual understanding precedes procedural skills. A teacher who is aware of the importance of conceptual understanding when teaching concepts will not teach procedural skills before learners have mastered the concepts involved.

4. What has research shown about the relationship between conceptual and procedural knowledge?

   Conceptual knowledge is constructed as problems are solved, investigations are carried out and questions are pondered (thought about).
5. How are meanings and connections among ideas develop?

   Research has shown that increasing a learner's conceptual knowledge leads to the ability to generate one's own procedures.

   There is a reciprocal relationship between conceptual and procedural knowledge, conceptual knowledge makes a greater contribution to procedural knowledge, than vice versa.
6. How is procedural fluency developed in the learners?

   Fluency is developed through much repetition and practice.
7. Assume that learners have already been introduced to the concept of "borrowing" when subtracting using Base 10 blocks. (See the example in A.) Explain in detail how you would explain the procedure being used in the vertical subtraction of 63 – 49.

   63 = 6 T + 3 O. 49 = 4 T + 9 O.

   We cannot subtract 9 O from 3 O.

   We go to 6 T and exchange it for 5 T and 10 O.

   This means that we now have 10 O + 3 O = 13 O.

   We can now subtract 9 O from 13 O and get 4 O.

   And we can subtract 4 T from 5 T and get 1 T.

   So, the answer is 1 T + 4 O or 14.

C: DEVELOPING LEARNERS' STRATEGIC COMPETENCE / OWN STRATEGIES (Maths Teaching and Learning Framework p. 17)

Modern societies and economies are in a constant state of flux. It is no longer sufficient for learners only to learn how to reproduce the steps in the calculations that they are shown by teachers. If we are to equip learners for the future, they need to be adaptable: to use knowledge and skills in flexible ways; to be able to retrieve knowledge and apply skills as the basis for new learning. Mathematics teaching and learning should develop learners who are able to adapt their knowledge and use their skills flexibly, not only as the basis for solving problems, but also as the foundation for learning new skills and knowledge.

Learners should be able to make sensible decisions on what strategies to employ or to devise their own strateg to solve certain problems. Often there is more than one way to solve a mathematical problem and it is important t learners do not always depend on fixed, prescribed methods to solve problems. This dimension includes two (relat skills:

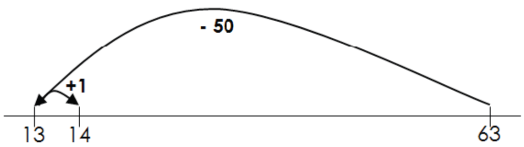
a) *Strategic competence* - the ability to formulate, represent and solve mathematical problems. Learners sho be able to read and make sense of a mathematical problem, look for possible patterns and use some strate to solve the problem. There may be a variety of strategies that are useful in different contexts. Part of strate competence is the ability to select and use an appropriate strategy in a given context.

b) Learners using their *own strategies* to approach a problem that cannot be solved using familiar strategies. tend to focus on technical, procedural aspects of mathematics and learners do not get the much needed expos to *problem solving* which is an integral part of mathematics. Learners need this exposure in order to develop th capacity to generate their own strategies since this is a basis for problem solving. Learners need to have and able to use procedures which they have at their disposal.

It is particularly useful to allow learners to use their own strategies when introducing a topic or a new section c topic, because it can help them to develop a better conceptual understanding of the topic. When learners discuss a compare their own strategies they can learn ways of reasoning and improving their calculations from their peers. learners try out new strategies they can find out whether the initial strategy used is particular to the example, or whet it is generalisable to many examples.

For example, learners could use many different strategies to calculate subtraction. Two examples of strategies shown below. There are many other possibilities! The strategies below should not be taught in a rote fashion as this c lead to misconceptions or incorrect use of the procedure. Correct working with mathematical strategies builds on a develops learners' number sense but only if learners understand how the procedure works.

64 – 49 = ☐

Strategy 1	***Strategy 2***
63 – 49 = 63 – 40 – 9 … the learner broke down 49 into 40 and 9 = 23 – 9 = 14	63 – 49 = 63 – 50 then add 1 back = 13 + 1 = 14 This can be shown on a number line 

Ultimately, learners should be guided to choose which strategy they find most efficient and prefer. They should also learn how to choose which strategy is most appropriate in a given context.

Learners need to develop their ability to *think out of the box* (i.e. to find strategies that have not been shown to them before) since this is useful for effective problem solving in mathematics. Bearing this in mind, the framework provides an example per phase of a more 'open' problem in addition to the more standard curriculum linked examples. When learners 'think out of the box' they are applying mathematical reasoning.

The beginning of 'out of the box' thinking is when learners are able to act independently – moving towards fluency and efficiency in the use of procedures in the solution of problems. An effective way of giving learners exposure to problem solving is through participation in mathematics competitions. These competitions include questions that learners have not generally seen before and for which standard taught procedures will not be sufficient to solve the problems. The perception that 'mathematics competitions are only for the gifted learner' is a myth. All learners, not only gifted learners, need to develop the thinking skills needed to solve non-standard problems. There are two official national events, the SA Mathematics Challenge (SAMC) for primary school learners, and the SA Mathematics Olympiad (SAMO) for secondary school learners (both organised by the SA Mathematics Foundation and endorsed by the national Department of Basic Education)3. There are also other regional or local mathematics competitions. Participating in these competitions could enable learners to grow their mathematical thinking skills.

1. What is strategic competence? Write a short definition / description.
   Strategic competence is the ability to formulate, represent and solve mathematical problems. Learners should be able to read and make sense of a mathematical problem, look for possible patterns and use some strategy to solve the problem. Part of strategic competence is the ability to select and use an appropriate strategy in a given context.
2. Why do learners need exposure to problem solving?
   They need exposure to problem solving in order to develop their capacity to generate their own strategies since this is a basis for problem solving.
3. How can using their own strategies help when introducing a new topic?
   Using their own strategies helps the learner to develop a better conceptual understanding of the topic. When learners discuss and compare their own strategies, they can learn ways of reasoning and improving their calculations from their peers. As they try out new strategies, they can find out whether the initial strategy used is particular to that example or whether it can be generalised to many examples.
4. What do we mean by "thinking out of the box"?
   Thinking out of the box means finding strategies that have not been shown to them before. Thinking out of the box is useful for effective problem solving in maths. When learners think out of the box, they are applying mathematical reasoning.
5. How can we help learners develop "out of the box" thinking?
   We can get the learners to practice answering questions from maths competitions and then getting the learners to enter maths competitions. Taking part in these competitions enables the learners to grow their mathematical skills.

D: DEVELOPING LEARNERS MATHEMATICAL REASONING
(Maths Teaching and Learning Framework p. 15)

Many learners see mathematics as a system of algorithms to be performed to get 'the right' answer. Along with otl components such as creativity and intuition, logic forms an integral part of mathematical thinking, however even adu sometimes find it difficult to reason in a formal logical way. To help learners reason mathematically, we need to tea them skills they do not possess naturally.

Mathematics is not simply a collection of isolated procedures and facts; it consists of a web of interconnected conce and relationships. If learners are taught mathematics as a series of disconnected procedures that need to be learnt by heart, they are likely to experience mathematics as meaningless. It will also mean that they have more to memor which deprives them of the opportunity to develop higher order thinking skills. If, on the other hand, learners a encouraged to connect topics and develop the practice of thinking '*What do I already know, that can help me here* they will reduce the strain on their memory and increase their reasoning abilities.

Learners use *inductive reasoning* to make generalisations based on evidence they have found. In this kind of reasoni facts are usually accumulated to convince us of the validity of a particular statement. *Inductive reasoning* starts w specific examples or observations and leads to a conjecture about the apparent rules or patterns that lie behind them mathematical example of *inductive reasoning* is the identification of a pattern in a sequence of numbers.

A large part of mathematics is based on an axiomatic system in which *deductive reasoning* is the accepted route to g new mathematical knowledge. *Deductive reasoning* starts with the rules (or axioms), and through *deductive reasoni* we determine what the consequences will be. This is what mathematicians do in most of mathematics, defining the ru for a mathematical entity (such as the basic axioms for Euclidean Geometry), and using these rules to prove that oth more complicated, facts are true. With *deductive reasoning* we can be absolutely sure of our conclusions - as long we assume the axioms are true.

Logical deductive reasoning is an important foundational skill in mathematics. Learning mathematics is a sequer process of building connections. If learners do not fully grasp a certain concept or procedure, they may strug to understand other concepts or procedures that follow – since these may depend on or build on the earlier ide Disciplined deductive mathematical reasoning is crucial to understanding and to using mathematics properly.

Reasoning mathematically involves learners talking about mathematics. Learners must learn to speak the langu of mathematics for themselves. They cannot do this without being given opportunities to 'talk mathematics'. Teach should support learners as they learn to develop their mathematical language. At times learners may be able to answers but struggle to explain how they got to the answers. Teachers should support learners to develop the langu and skills needed to talk about their thinking, answers and solution strategies.

As learners progress they need to learn to work (and speak about mathematical objects) more abstractly. This requ them to start to reason by making use of formal mathematical definitions in order to justify their answer or to build argument.

For example, learners need to move from a simplistic claim that a shape is a rectangle: 'it is a rectangle because it longish shape with two long sides and two short sides and four corners' to a more sophisticated argument: 'a shape rectangle if its opposite sides are equal **and** it has four right angles'. In the first case learners will not acknowledge a square is also a rectangle while in the more formal abstract discourse a square is clearly a special case of a rectan

In the example below the Grade 2 learner's answer shows the use of mathematical language to explain how reasoned when finding a solution based on given information.

> ***Question:*** If 63 – 49 = 14, then what is 63 – 39?
> ***A learner used reasoning to answer as follows:***
> I am subtracting 10 less and so the answer must be 10 more.
> The answer is 24.

1. What combines to form mathematical reasoning.

Creativity, intuition (the ability to understand something without the need for reasoning), and logic form an integral part of mathematical reasoning.

2. Is maths just a collection of isolated procedures and facts?

   No, it isn't. it consists of a mass of interconnected concepts and relationships.

3. What happens if learners are taught maths as a series of disconnected procedures that have to be learned off by hear?

   Learners will experience maths as meaningless. They will spend time memorising facts and don't have time to develop higher order thinking skills. They should be encouraged to ask themselves "what do I already know that can help me here?"

4. What is meant by Inductive Reasoning? Give an example of Inductive Reasoning.

   Inductive reasoning starts with specific examples or observations and leads to a conjecture (an opinion or conclusion) about the apparent rules or patterns that lie behind these examples or observations.

   An example of inductive reasoning is identifying a pattern in a sequence of numbers.

5. What is meant by Deductive Reasoning? Give an example of Deductive Reasoning.

   Deductive reasoning starts with rules (or axioms). We use deductive reasoning to determine what the consequences will be.

   An example of deductive reasoning is using axioms and theorems in Euclidian Geometry to solve geometry problems or riders.

6. Why should learners be encouraged to talk about maths?

   Reasoning mathematically involved learners talking about maths. Teachers should support learners as they learn to develop their mathematical language and skills needed to talk about their thinking, their answers and their solution strategies.

E: PROMOTING AND NURTURING A LEARNING CENTRED CLASSROOM (Maths Teaching and Learning Framework p. 19)

A learning-centred classroom creates a platform for meaningful learning and teaching. The framework diagram illustra this by placing the learning-centred classroom as the foundation for all of the other dimensions of the framework. Teach need to create classrooms where the stage is set for learning mathematics for understanding. The term "learn centred" has been chosen very deliberately. Much has been written and said about *learner-centred* and *teacher-cen* classrooms. Often it has been suggested that "teacher-centred is bad" and "learner-centred is good". Such dichoton are not helpful and they are not accurate. There are many reports of so-called learner-centred classrooms where it not clear what learners were supposed to be learning. On the other hand, we read of so-called teacher-centred teach where learners displayed a good grasp of what their teacher had explained using a so-called chalk-and-talk approa

A **learning**-centred classroom focuses on *learning* – where the teacher designs learning experiences to help learn learn mathematics, using whatever teaching and learning strategies s/he thinks are most suitable for the specific les that will be taught.

A **learning**-centred mathematics classroom is characterised by a culture of interaction between teachers and learn in the process of 'doing mathematics'. The teacher plays an important role in establishing and nurturing this cult The way in which a teacher conducts a classroom, depends on the way in which s/he views mathematics. A teac who sees mathematics as a body of knowledge which s/he has to impart to learners, will mostly tell learners wha do, and how to do it. On the other hand, a teacher who sees mathematics as a body of knowledge that learners m actively explore and engage with, will create a learning environment where learners can make sense of mathemat They will have opportunity to express their ideas, to ask questions of the teacher and each other and discuss their w of thinking about the work at hand.

Teachers must direct and be in control of the path of learning but they must see the learners' role as active in develop understanding and taking ownership of what they have learned. For example, in the Foundation Phase, focused guided play-based learning should be promoted because it is an important component of active learning of mathemat

The CAPS Grades R - 12 aims to develop citizens that are able to:

- identify and solve problems and make decisions using critical and creative thinking;
- work effectively as individuals and with others as members of a team;
- organise and manage themselves and their activities responsibly and effectively;
- collect, analyse, organise and critically evaluate information;
- communicate effectively using visual, symbolic and/or language skills in various modes;
- use science and technology effectively and critically showing responsibility towards the environment and health of others; and
- demonstrate an understanding of the world as a set of related systems by recognising that problem solv contexts do not exist in isolation.

It is evident that the CAPS emphasises the importance of developing learners' ability to solve problems and to share communicate their ideas. In a **learning**-centred mathematics classroom learners will have opportunity to:

- make sense of mathematics
- speak mathematics
- develop fluency in essential mathematical procedures
- connect representations
- justify their thinking

In a **learning**-centred mathematics classroom teachers will:

- use assessment for learning
- provide clear explanations of concepts and procedures
- address learners' errors and misconceptions
- address gaps in learners' knowledge
- make connections between different topics
- provide opportunities for active learning
- select and design tasks that emphasise key mathematical ideas and ways of working mathematically
- encourage learners to speak mathematics and use mathematical notation accurately

All four dimensions of the framework are closely linked and in a learning-centred classroom they will interact dynamic Some dimensions will come to the foreground in some lessons while other dimensions will come more strongly focus in other lessons. All this comes together as teachers strive to teach mathematics for understanding to en learners to learn mathematics with understanding.

An interactive lesson can develop around examples which a teacher has written on the board or in the context of ano activity planned by the teacher.

Teaching in an environment where learners are active and talk through their own learning calls for careful tea preparation. Teachers might have to take on a different role, and that could make them feel insecure. A learning-cen classroom calls for more freedom on the part of learners. This requires careful planning from the teacher.

The teacher must prepare the lessons in much more detail, taking into consideration the possible questions problems that learners could encounter. As teachers work consistently towards creating a learning-centred classro environment, they will become more familiar with the type of questions and problems that learners encounter.

Teachers will be better prepared to teach interactively as they become more experienced in creating a learning-cent classroom. Once the initial work has been done to create scenarios where learners are involved in solving proble collaboratively and independently, the teaching load will become less.

Teachers are sometimes under the impression that they must control of all of the learning that takes place in t classrooms when in fact this is not the case. Teachers should be in control of the learning pathways they direct, but t must do this to create independent learners.

Learners must take responsibility for and control of their own learning in order to become independent learners thinkers, able to operate mathematically in the world without the teacher.

The role of the teacher should thus be to create an environment in which learners are provided rich activities thro which they can develop their independence and control their own learning. To create such a classroom is not alw easy but the benefits to be reaped are those mentioned above – independent learners, capable of thinking and work on their own and doing mathematics in a meaningful way.

1. Look at the framework diagram again and confirm that the diagram places the learning-centred classroom as the foundation for all of the other dimensions of the framework.
2. What is a learning-centred classroom?

   A learning centred classroom focusses on learning where the teacher designs learning experiences to help learners learn mathematics.
3. What culture is found in a learning centred classroom?

There is a culture of interaction between teacher and learners, both involved in 'doing mathematics'.

4. What will learners in a leaning centred classroom have the opportunity to do?
   They will have an opportunity to make sense of maths; speak maths; develop fluency in essential maths procedures; make connections; justify their thinking.
5. What is the role of the teachers in a learning-centred maths classroom?
   The teachers will use assessment for learning; provide clear explanations of concepts and procedures; address learners' errors and misconceptions; address gaps in learners' knowledge; make connections between different topics; provide opportunities for active learning; select and design tasks that emphasise key mathematical ideas and ways of working mathematically; encourage learners to speak mathematics and use mathematical notation correctly.
6. Teaching in an environment where learners are active and talk through their learning calls for careful teacher preparation. What points should the teacher consider in order to create a learning centred classroom?
   - ***The teacher must prepare the lessons in more detail, taking into consideration the possible questions and problems that learners could encounter. (As teachers work consistently towards creating a learning-centred classroom environment, they will become more familiar with the type of questions and problems that learners encounter.)***
   - ***Teachers need to be prepared to teach interactively. Once the initial work has been done to create scenarios where learners are involved in solving problems collaboratively and independently, the teaching load will become less.***
   - ***Teachers should not feel that they must control of all of the learning that takes place in their classrooms. Teachers should be in control of the learning pathways they direct, but they must do this to create independent learners.***
   - ***The teacher needs to create an environment in which learners are provided rich activities through which they can develop their independence and control their own learning. Learners must take responsibility for and control of their own learning in order to become independent learners and thinkers, able to operate mathematically in the world without the teacher. To create such a classroom is not always easy but the benefits to be reaped are those mentioned above – independent learners, capable of thinking and working on their own and doing mathematics in a meaningful way.***

Using Simplified Base 10 blocks

In the first term, Grade 4 learners have to use the column method to

- add numbers up to 5 digits where the sum is either a 5-digit number or a 6-digit number
- subtract 6-digit numbers (borrowing once / borrowing twice / borrowing from hundreds to calculate Ones).

NOTE: The column method is also sometimes referred to as the vertical method or vertical addition and subtraction.

To assist the learners to understand the column method, it is strongly suggested that each step of a vertical addition and subtraction is scaffolded by the use of Base 10 Blocks.

Base 10 Blocks

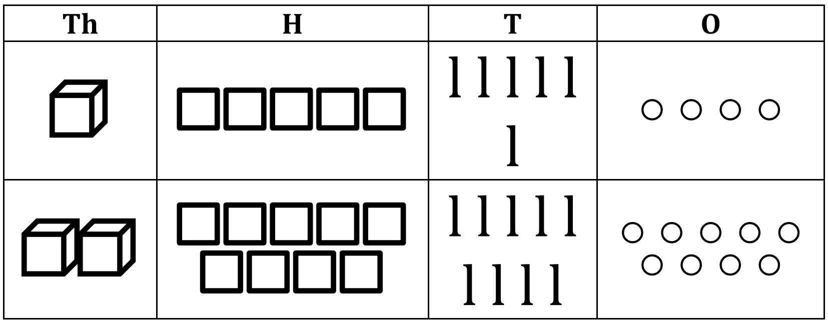
- A Base 10 Kit containing photocopiable large blocks is given in the Grade 4 Teacher Resource.
- A smaller photocopiable Base 10 Kit is given in the Grade 4 Learner Activity Book for Term 1.
- Simplified pictures of the Base 10 blocks can be drawn on the board. (*This recommended for Grade 4)*. This is known as a simplified pictorial representation.

1) USING BASE 10 BLOCKS TO HELP LEARNERS TO ADD LARGE NUMBERS VERTICALLY

Example 1: 1 564 + 2 999 = ☐

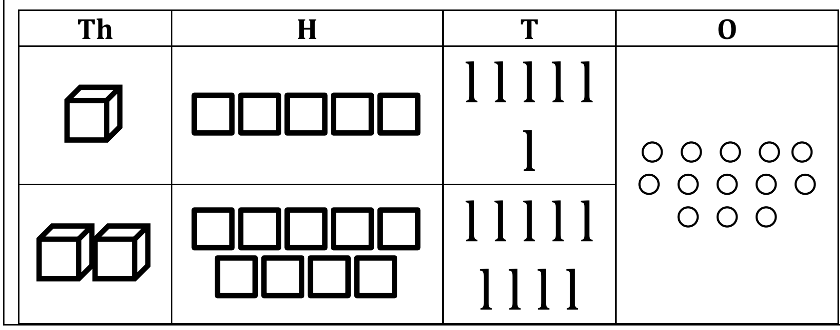
SOLUTION

Step 1: Set out the Base 10 blocks with the vertical addition next to it:



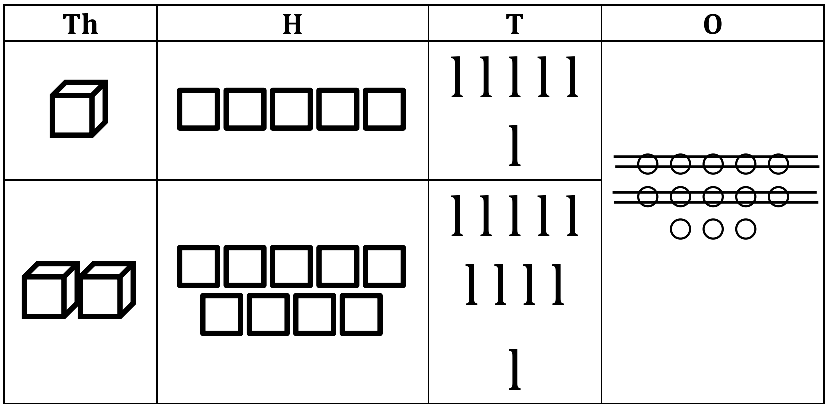
	Th	H	T	O
	1	5	6	4
+	2	9	9	9

Step 2: Add the Ones. We get 13 Ones.



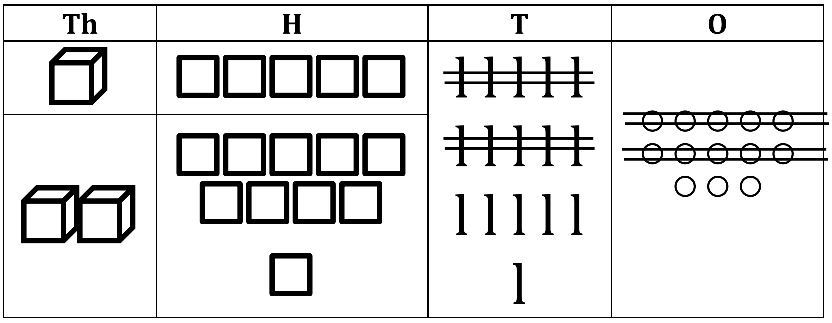
	Th	H	T	O
	1	5	6	4
+	2	9	9	9

Step 3: Exchange 13 Ones for 1 ten and 3 Ones.



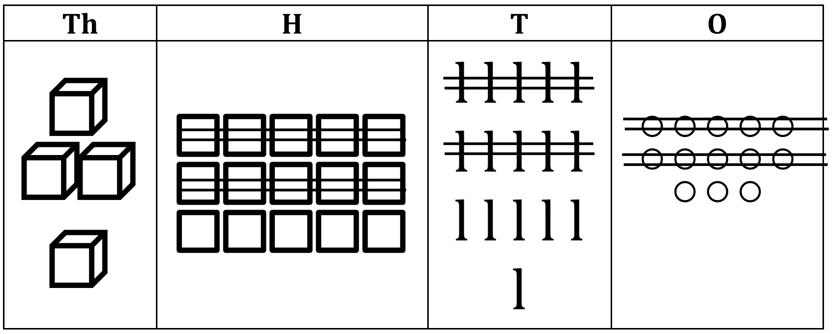
	Th	H	T	O
			1	
	1	5	6	4
+	2	9	9	9
				3

Step 4: Add the tens. We have 16 tens. Exchange 16 tens for 1 hundred and 6 tens.



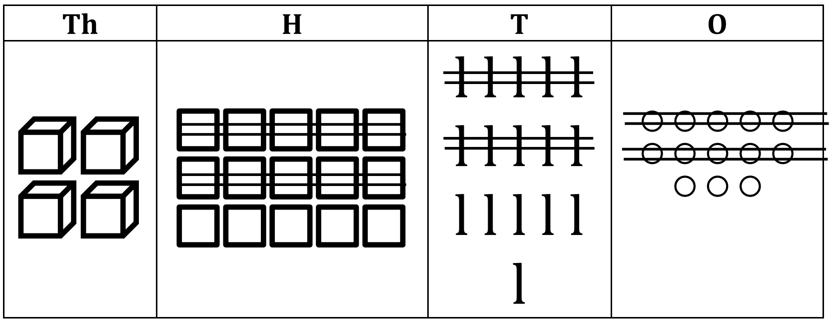
	Th	H	T	O
	1	1	1	
	1	5	6	4
+	2	9	9	9
			6	3

Step 5: We have 15 hundreds. Exchange 15 hundreds for 1 thousand and 5 hundreds.



	Th	H	T	O
	1	1	1	
	1	5	6	4
+	2	9	9	9
		5	6	3

Step 6: We have 4 thousands.



	Th	H	T	O
	1	1	1	
	1	5	6	4
+	2	9	9	9
	4	5	6	3

ANSWER: 1 564 + 2 999 = 4 573

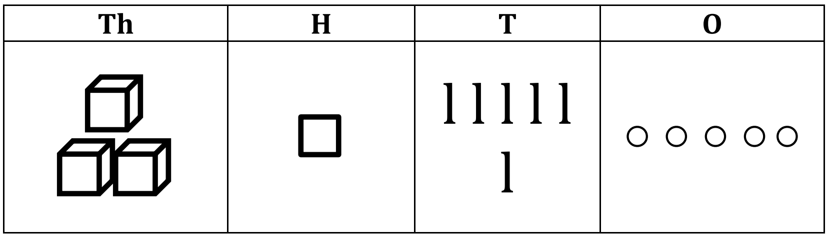
I was then planning on giving the participants 2 different examples involving “carrying” and asking them to work in pairs describing what to do.

2) USING BASE 10 BLOCKS TO HELP LEARNERS TO SUBTRACT LARGE NUMBERS USING THE VERTICAL OR COLUMN METHOD

Example 1: 3 165 – 1 432 = ☐

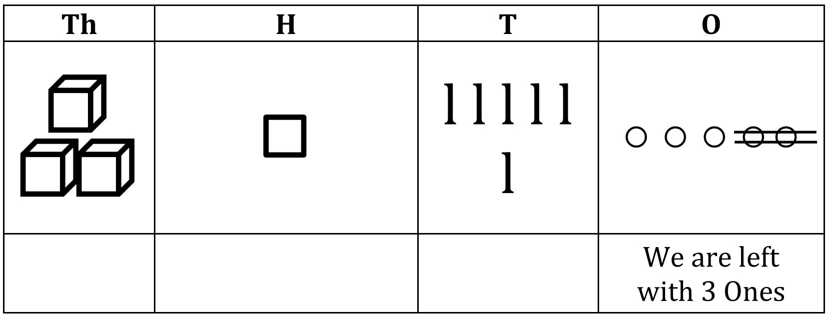
SOLUTION

Step 1: Set out the Base 10 blocks showing the FIRST NUMBER ONLY with the vertical subtraction next to it.



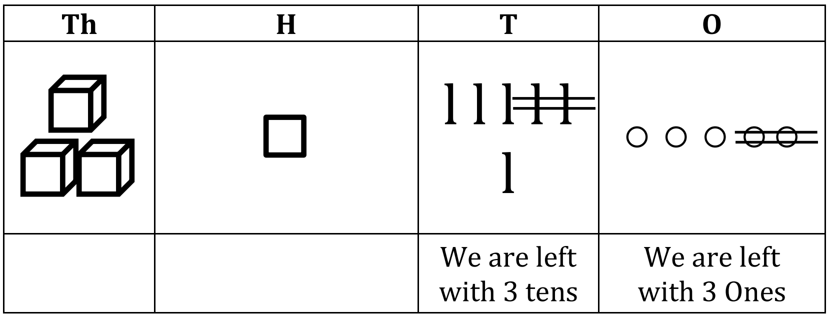
	Th	H	T	O
	3	1	6	5
–	1	4	3	2

Step 2: We start with the Ones. Subtract 2 Ones from 5 Ones.



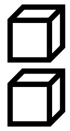
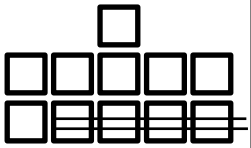
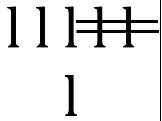
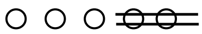
	Th	H	T	O
	3	1	6	5
–	1	4	3	2
				3

Step 3: Now subtract 3 tens from 6 tens.



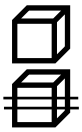
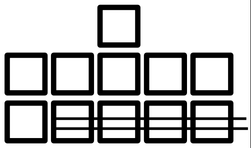
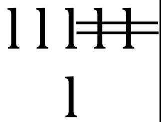
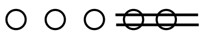
	Th	H	T	O
	3	1	6	5
–	1	4	3	2
			3	3

Step 4: We cannot subtract 4 hundreds from 1 hundred.
We borrow 1 thousand from the 3 thousands we have. We exchange 1 thousand for 10 hundreds. We add the 10 hundreds to the 1 hundred we already have. Now we have 11 hundreds.

Th	H	T	O
			
We have 2 thousands left	Subtract 4 hundreds from the 11 hundreds We are left with 7 hundreds	We are left with 3 tens	We are left with 3 Ones

	Th	H	T	O
	2			
	~~3~~	$^{1}1$	6	5
-	1	4	3	2
		7	3	3

Step 5: Now we subtract 1 thousand from 2 thousands.

Th	H	T	O
			
We are left with 1 thousands	Subtract 4 hundreds from the 11 hundreds We are left with 7 hundreds	We are left with 3 tens	We are left with 3 Ones

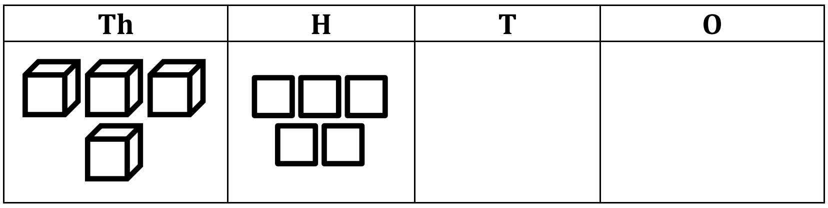
	Th	H	T	O
	2			
	~~3~~	$^{1}1$	6	5
-	1	4	3	2
	1	7	3	3

ANSWER: 3 165 – 1 432 = 1 733

Example 2: 4 500 – 1 327 = ☐

SOLUTION

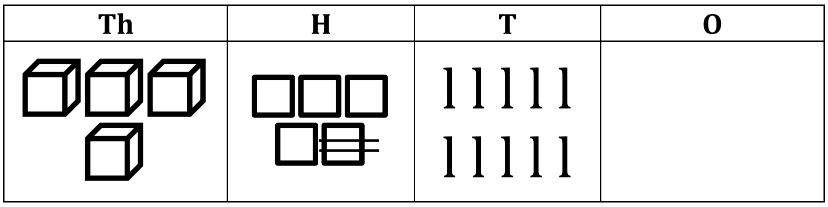
Step 1: Set out the Base 10 blocks showing the FIRST NUMBER ONLY with the vertical subtraction next to it.



	Th	H	T	O
	4	5	0	0
-	1	3	2	7

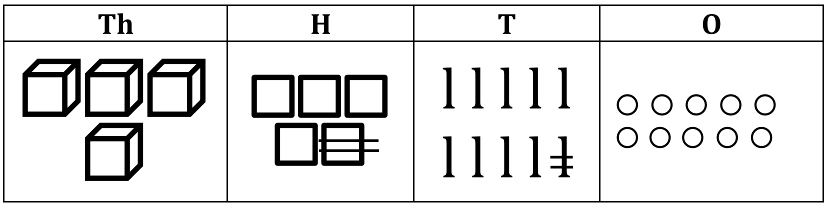
We cannot subtract 7 Ones from 0 Ones, so we go to the tens column.
We cannot borrow from the tens column, so we go to the hundreds column where we have 5 hundreds.

Step 2: We borrow 1 hundred from the 5 hundreds we have. We exchange 1 hundred for 10 tens. We now have 4 hundreds and 10 tens



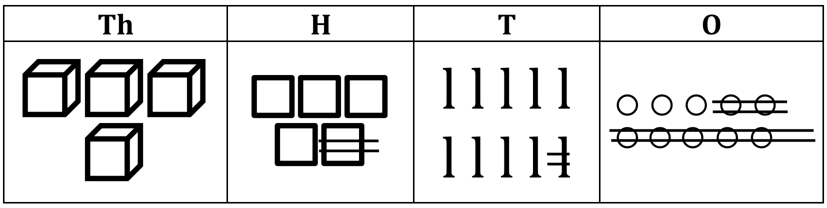
	Th	H	T	O
		4		
	4	~~5~~	10	0
-	1	3	2	7

Step 3: We cannot subtract 7 Ones from 0 Ones, so we borrow 1 ten from the tens column.
We exchange 1 ten for 10 Ones. *We say we have borrowed 1 ten.*
We now have 9 tens and 10 Ones.



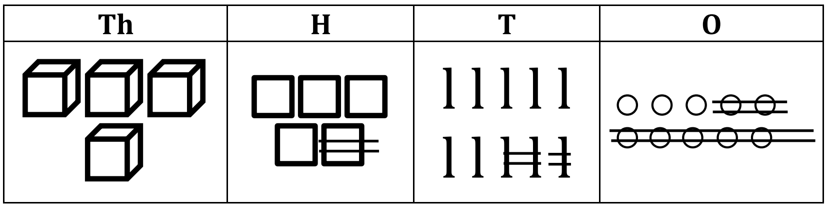
	Th	H	T	O
		4	9	
	4	~~5~~	~~10~~	10
-	1	3	2	7

Step 4: We can now subtract 7 Ones from the 10 Ones we have. We are left with 3 Ones.



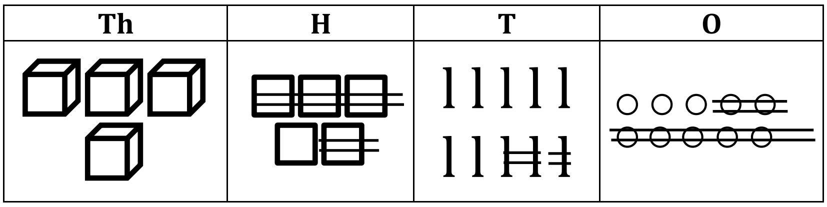
	Th	H	T	O
		4	9	
	4	~~5~~	~~10~~	10
-	1	3	2	7
				3

Step 5: We can now subtract 2 tens from 9 tens we have left. We are left with 7 tens



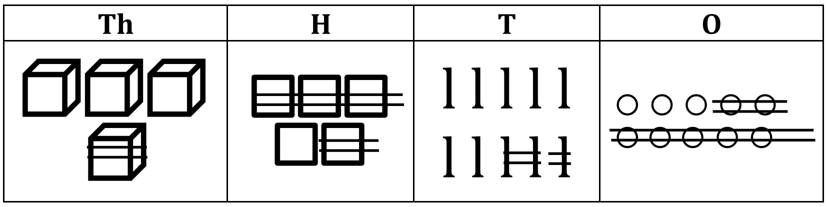
	Th	H	T	O
		4	9	
	4	~~5~~	~~10~~	10
-	1	3	2	7
			7	3

Step 6: We can now subtract 3 hundreds from 4 hundreds we have left. We are left with 1 hundred.



	Th	H	T	O
		4	9	
	4	~~5~~	~~10~~	10
-	1	3	2	7
		1	7	3

Step 7: We can subtract 1 thousand from the 4 thousand that we have. We are left with 3 thousand.



	Th	H	T	O
		4	9	
	4	~~5~~	~~10~~	10
-	1	3	2	7
	3	1	7	3

ANSWER: 4 500 – 1 327 = 3 173

I was then planning on giving the participants 2 or 3 different examples involving "borrowing" and asking them to work in pairs describing what to do.