

## Inquiry Math Lesson Structure: Summary

These inquiry steps below can be used in your classroom: The steps are worded both succinctly and rephrased with more child friendly language.

### SUMMARY (TEACHER VERSION)

#### *5 phases of an Inquiry Maths Lesson:*

- 1) **Explore:** Explore the Focus Task using manipulatives
- 2) **Share:** Students share strategies
- 3) **Understand:** Teacher synthesises understanding
- 4) **Practice:** Students perform practice tasks to strengthen understandings and to build fluency
- 5) **Reflect:** Students review and explain the key concept(s) of the lesson.

*During these phases ensure the concept is shown at all three stages of conceptual development that interact with each other. **Materials (Concrete), Modelling (Pictorial), and Generalised (Abstracted) (CPA)**. Ideally a new concept should progress from the literal to the representational before mastery is shown (primarily mentally).*

**LITERAL (Enactive)**



**REPRESENTATIONAL (Iconic)**

### SUMMARY (CHILD FRIENDLY VERSION)

#### *The 5 phases OUR Maths Lessons:*

- 1) **Explore:** We Explore the Focus Task using concrete materials
- 2) **Share:** We share our strategies and ideas with our friends
- 3) **Understand:** Our teacher helps put together all of our ideas
- 4) **Practice:** We practice other questions to better understand the ideas we have discovered
- 5) **Reflect:** We think back on the main idea of the lesson

*During our maths lesson we will show our ideas in three ways.*

**CONCRETE**



**PICTORIAL**



**MENTAL**

# The Inquiry Math Lesson Structure: Expanded & Explained

## Adapted & Synthesized to suit:

- Singapore Maths Curriculum
- IB PYP
- New Zealand's Numeracy Project

### 1) Explore: **10 - 30 Minutes (Approx)**

Explore a Focus Task (primarily) using manipulatives. The Focus Task is often referred to as the Anchor Task. Sometimes called a 'Before you Learn' or preparation to learn phase.

Teachers should encourage the use of concrete manipulatives, and visual representations, which help demonstrate the essential skill or concept. This is an excellent time for the teacher to observe conceptions and misconceptions for both formative assessment purposes and to refine the structure of the upcoming share and understand phases of the lesson.

#### WHY?

From **Zoltan Dienes & Piaget**. The exploration phase is a critical step. As the students construct their own understandings with tactile materials and visuals, all of the brains' senses are activated. Accordingly, ideas will have a greater chance to be linked to prior understandings and transferred to long term memory. Such ideas are also proven with subsequent empirical studies that suggest all humans have a concrete developmental stage of cognitive bias. For each new concept a person must have an opportunity to explore at the physical or literal. Otherwise connections won't be made and deeper understanding harder to develop.

An exploration phase done well should develop a students **Number Sense** as well as their **Visualisation**, and **Metacognition** skills.

### 2) Share: **5 - 20 Minutes (Approx)**

Students share strategies previously explored. This is an opportunity to discuss ideas, of what students have done and why. By doing so the class can celebrate successes, note misconceptions, and analyse errors that may have occurred (which really promotes deep learning.) The teacher can continue to formatively assess students individually while this is happened as well as the class as a whole for depth of understanding of the targeted concept.

#### WHY?

Theory of Sharing from **Jerome Bruner**. It is necessary to abstract explored ideas and for children to verbalise their attempts at understanding for ideas to be retained. Students by doing this phase well will be developing their **communication**, and **reflection** skills.

#### **NOTE:**

**This is a tilt phase:** The teachers observations of the class understanding will influence the direction the lesson should now go in. There may be adaptations or micro lessons that need to happen on a prior concept, or some other form of teacher synthesis and clarification.

### 3) Understand: **5 – 20 Minutes (Approx)**

Teacher synthesises understanding of the essential targeted concept and the students ideas together. If following a Singapore Math book or structure this is usually when the pupil books get opened for the first time so that they can see the 'formal' explanation of the concept. Sometimes this is called the 'teacher', 'learn' or 'instructional' phase. The teacher is recommended to show the concept or skills in a variety of sensory modes ideally with both materials and with models.

Encourage children to document a formal understanding of this information for later reflection. Use open ended probe questions to extend mathematical reasoning chances to the students directly. For example; What is going on here? Why do you think...? If this happens here... then what does that mean for \_\_\_?

### **WHY?**

This theory for Understanding phase is supported by the seminal works from **Vygotsky** and **Skemp**. Being able to see a summary of ideas reinforces the learners conceptions and helps eliminate misconceptions. Encouraging rationalisation of ideas helps develop the logical metacognitive thought processes, and encourages students to think of a larger relational pattern of mathematical understanding.

## **4) Practice: 15 – 45 Minutes (approx)**

Students perform practice tasks to strengthen understandings and build procedural fluency. This can initially come in the form of *guided practice* (with peers, whole class with teacher), which will help eliminate any final misconceptions.

Students should also do some *Independent practice*. Several questions should be attempted with the goal of developing mastery of both procedures and concept. Additional practice may also help with training towards automaticity of specific essential facts. Practice tasks should be designed to help progress the student from a working visual understanding to an abstracted symbolic and mental understanding.

### **WHY?**

Mathematic concepts and skills are hierarchical. Learning needs to be scaffolded systematically to develop an understanding that builds on mastery of prior concepts. Ideally, students should solidify one idea before moving on, so it can be effective as a base for a new concept.

## **5) Reflect: 5 – 30 Minutes (approx)**

Students review and explain the key concept(s) of the lesson. Useful probing questions or tasks could be. Think of a title that summarises what you have learned today. How does this concept work. Why does this idea work? How does this idea relate to...

Reflection phase is designed to allow the student to refocus and reorientate their learning back to the big essential ideas as represented in the focus task.

### **WHY?**

Theory of solid reflection comes from **Vygotsky**, and **Skemp**. It is necessary to review skills and place them in context of the deeper mathematical patterns and ideas to develop *Relational Understanding*. Through this process the big ideas understandings to be retained and placed in long term memory.

### **A note on timings:**

*Lower end timings equate to only 40 minutes or one brief Math period. Upper end timings about 2.5 hours of teaching time. The phases are dependant upon the complexity of the concept, and a lesson can span multiple periods or days. However, as a general rule: **Keep all phases short, and reinforce essential concepts to maintain learning momentum, while keeping expectations for student achievement high.***

***IF** timings for a concept is likely to exceed the upper limits suggested here, then it would be recommended to break the concept down into smaller sub concepts.*