# Session Plan

## Secondary Mastery Big Idea: Representation and Structure

This professional development module is one of a suite of six modules designed to introduce secondary maths trainee teachers to the NCETM's Teaching for Mastery 5 Big Ideas. Each module shares a rationale, key messages and at least one practical strategy suitable for novices to adopt. Together, the modules form an introduction to teaching for mastery for the novice.

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| **Goals** | To help trainee teachers (TT) to:<br>❑ understand the what, why and how of representation and structure<br>❑ explore a manipulative and representation<br>❑ consider how it can be used in teaching. |
| **Starting points** | TT will have seen the teaching for mastery diagram with the 5 Big Ideas in the Introduction module. They may have met some manipulatives and representations in their training. |
| **Materials required** | PC & projector<br>Whiteboard or flipchart & pens<br>Group set of mini whiteboards & pens<br>Class set of algebra tiles (available here https://completemaths.com/teaching-tools/physical-manipulatives or made from coloured card) shared between pairs of TT<br>Session handout (optional) |
| **Time needed** | 60 minutes |
| **Room layout** | Room layout should accommodate TT working in pairs and groups of four. |
| **Suggested approach** | Share Teaching for Mastery Framework (S2) and highlight that this session will explore Representation and Structure. |

**Exposing rationale (5 minutes)**

Share the key messages (S3) allowing TT time to read (page 1 of handout).

Make link to Bruner's CPA approach (S4).

**Definition, evidence and guidance (5 minutes)**

What do we mean by representations? Note that language and symbols are also representations of abstract ideas. (S5-7)

What is the evidence for the use of representations and manipulatives? (S8)

What guidance is available? Refer TT to guidance produced by the NCETM (S9).

**Practical application: Algebra tiles**

We explore algebra tiles as a form of bar modelling for algebra. After allowing time for TT to tackle each of the tasks, use https://mathsbot.com/manipulatives/tiles to model answers for discussion.

**1. Adding and subtracting directed numbers (15 minutes)**
Introduce the first algebra tile and negative equivalent. Ask TT to represent three using their unit squares. Then another way, and another way to introduce the idea of zero pairs (S10).

Task TT to represent the given calculations using unit squares (S11). Ask TT to consider which are more difficult to model and why. What difficulties might students encounter? How can you overcome them?

**2. Representing algebraic expressions (10 minutes)**
Introduce other tiles (S12 and13). Task TT with using them to create the given expressions. The second column throws up some interesting issues to discuss: how can the first expression help with expanding and factorising? (It is the same as $(x + 1)2$). Is the second expression best represented as $x + 1$ or $x + (-1)$? How can we represent $x/2$ usefully? Does this point to the limit of the usefulness of manipulatives – and that they serve as a scaffold?

**3. Factorising algebraic expressions (10 minutes)**
Ask TT to factorise the given expressions by trying to create a rectangle (S16). Depending on their subject knowledge, this may need modelling first.

**4. Solving equations (10 minutes)**
Ask TT to explore how they might solve linear equations using algebra tiles and how they might solve quadratics (S17).

Discuss findings.

**Summary (5 minutes)**

Refer TT to NCETM guidance on algebra tiles (S18).

Discuss the key considerations (S19) from the EEF Guidance Report (see report or slide notes). Note how the effective use of representations fits into the wider picture of working mathematically, as noted in the Nuffield Key Understandings report (S20).

Return to the key messages (S21) and discuss in pairs how the strategy addresses these.

Close with more info and encourage TT to connect with the NCETM and their local Maths Hub (S22-24).

| **What TT might do next** | Practise using algebra tiles to model scenarios from textbooks or worksheets. |