Lesson 04: Marble Maze Box - Finding the Hidden Structure (Low-Inquiry Version)

Lesson Title: Marble Maze Mystery: Following the Path
Intended Grade Level(s): Grades 4-12 (adaptable)

I. Planning

Lesson Focus / Goals

The lesson aims to provide the following for students:

- Practice making observations based on auditory and tactile information
- Learn to follow step-by-step procedures for mapping hidden structures
- Understand the difference between observations and inferences

Learning Objectives

By the end of the lesson, students will be able to:

- Follow the teacher-provided procedure for testing the marble maze box
- Record observations using the data collection sheet
- Reproduce the teacher's diagram of the maze interior
- Distinguish between observations (what they sense) and inferences (what they conclude)

Standards Alignment

Standards for Mathematical Practice (Common Core):

- **MP6** – Attend to precision.
- **MP7** – Look for and make use of structure.

NGSS Science and Engineering Practices:

- **Planning and Carrying Out Investigations** – Students follow procedures to collect data systematically.
- **Analyzing and Interpreting Data** – Students record observations and use them to create representations.

Materials Needed

The following materials are used in the lesson:

- **Marble maze boxes** (1 per pair) - sealed shoeboxes with internal maze structure made from cardboard dividers and a marble inside
- **Data collection sheets** with pre-labeled testing positions (8 positions: N, NE, E, SE, S, SW, W, NW)

- **Teacher demonstration box** (identical to student boxes) for modeling
- **Document camera** to show teacher's diagram
- **Final answer key** - the actual maze diagram that students will verify at the end
- **Pencils and erasers** for recording

II. Implementation

Lesson Flow

Before: (Launch – 7 min)

1. Show sealed marble maze box
2. Explain: "Inside this box is a maze. There's a marble that can roll through it. Your job is to figure out what the maze looks like inside - WITHOUT opening the box."
3. Demonstrate the **testing procedure** using document camera:
   - Hold box flat
   - Tilt to position N (North/top edge down)
   - Listen and feel for marble movement
   - Record: "Marble rolled" or "Marble stopped"
   - Return to flat position
   - Repeat for each of the 8 positions in order: N, NE, E, SE, S, SW, W, NW
4. Show **data collection sheet**: "You'll test all 8 positions and record your observations in this order."
5. Emphasize: "Follow the exact procedure. Don't skip positions or go out of order."

During: (Explore – 13 min)

- Distribute boxes (1 per pair) and data collection sheets
- Students work in pairs to test all 8 positions
- Students record "rolled" or "stopped" for each position
- Teacher circulates to ensure:
  - Students are testing in the correct order
  - Students are recording observations (not inferences like "there's a wall here")
  - Students are returning to flat position between each test
- After all pairs finish data collection (8-10 min):
  - Teacher shows **answer key diagram** on document camera
  - Teacher explains: "Based on the rolling patterns, here's what the inside looks like…"
  - Students copy the diagram
  - Teacher explains how each observation supports the diagram: "When we tilted North and the marble rolled, that means there's an open

channel on this side…"

After: (Discuss – 5 min)

- Teacher opens one box to reveal the interior
- Compare physical maze to diagram
- Ask: "Did our observations match the actual structure?"
- Discuss: "What's the difference between an observation and an inference?"
  - Observation: "The marble rolled when tilted North"
  - Inference: "There's a channel on the north side"
- Emphasize: "Scientists collect observations first, then make inferences based on evidence."

III. Assessment

Formative: During the lesson, monitor if students:

- Are following the testing procedure in the correct order
- Are recording observations accurately (rolled/stopped)
- Are distinguishing observations from inferences
- Successfully copied the answer key diagram

Exit Ticket: Students answer two questions: 1. Write one OBSERVATION you made about the marble's movement. 2. Write one INFERENCE you can make based on that observation.

Peer/Self-Assessment: Pairs compare their data sheets to verify they got the same results when testing their box.

Student Data Collection Sheet

Names: _____ **&** _____
Date: _____

Marble Maze Investigation

Testing Procedure: 1. Hold box flat (horizontal) 2. Tilt box to the position listed below 3. Listen and feel for marble movement 4. Record whether marble ROLLED or STOPPED 5. Return box to flat position before testing next position

IMPORTANT: Test positions IN ORDER. Do not skip ahead.

Position	Direction	Marble Movement (Circle one)
1. N	North (top edge down)	ROLLED / STOPPED
2. NE	Northeast (top-right corner down)	ROLLED / STOPPED

Position	Direction	Marble Movement (Circle one)
3. E	East (right edge down)	ROLLED / STOPPED
4. SE	Southeast (bottom-right corner down)	ROLLED / STOPPED
5. S	South (bottom edge down)	ROLLED / STOPPED
6. SW	Southwest (bottom-left corner down)	ROLLED / STOPPED
7. W	West (left edge down)	ROLLED / STOPPED
8. NW	Northwest (top-left corner down)	ROLLED / STOPPED

Maze Diagram

After collecting all data, your teacher will show you what the maze looks like inside. Copy the diagram below:

[Large blank square for diagram]

Exit Ticket

1. Write one OBSERVATION you made about the marble's movement:

2. Write one INFERENCE you can make based on that observation:

Reflection

What was challenging about this activity? What made it easier?