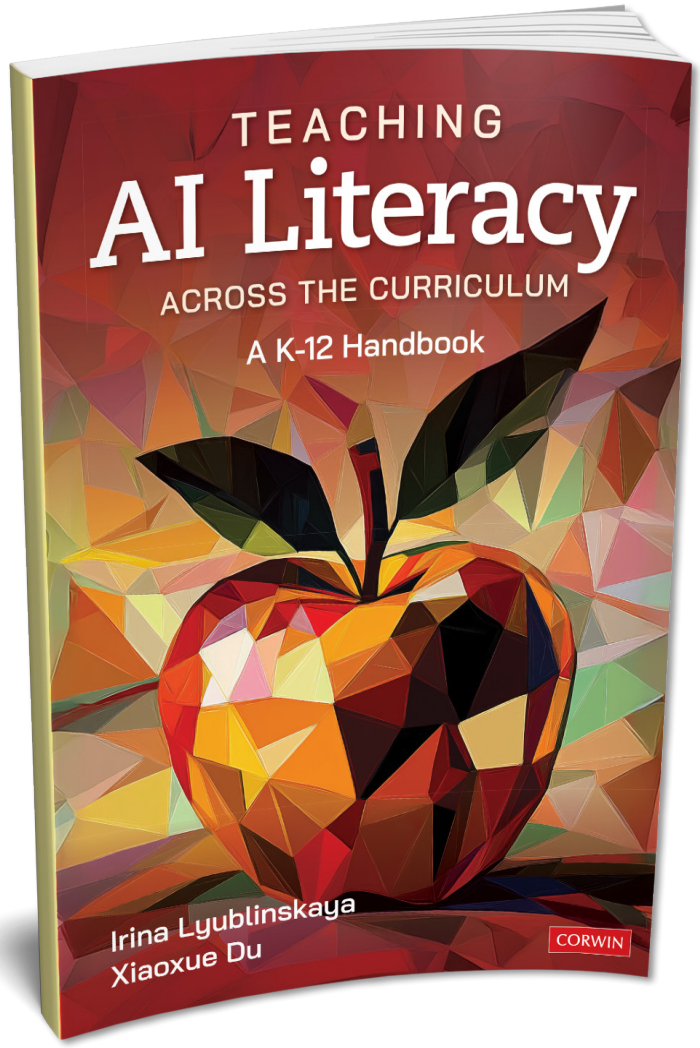

Thank you

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CORWIN

6.3 Lesson: Number Patterns

For Elementary School

MP7. Look for and make use of structure.

Students who are mathematically proficient look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well-remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property.

Grade 3: Operations & Algebraic Thinking

3.OA.D. Solve problems involving the four operations, and identify and explain patterns in arithmetic.

3.OA.D.9. Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations.

Overview:

Start the activity by giving students several simple arithmetic sequences to explore and identify the rules behind each pattern, for example:

3, 6, 9, 12, . . . (multiples of 3)

2, 4, 8, 16, . . . (powers of 2)

Ask students to explain these patterns using properties of operations. Introduce the concept of "rule finding" as something humans and computers can do. Explain that AI systems look for patterns in large amounts of data.

You can then challenge students to look at the structures within numbers in more complex sequences, such as 1, 2, 4, 7, 11, 16, ... Let students make predictions of the next numbers in sequences, discussing their reasoning and strategies. Guide students to notice relationships, such as the growing differences between consecutive numbers. Discuss how recognizing this underlying structure helps predict future numbers in the sequence.

Suggested Extensions and AI Connections:

1. Use a 100 chart and have students shade the numbers in the sequence to observe visual patterns in arithmetic sequences. This approach creates visual structures that can help students to develop

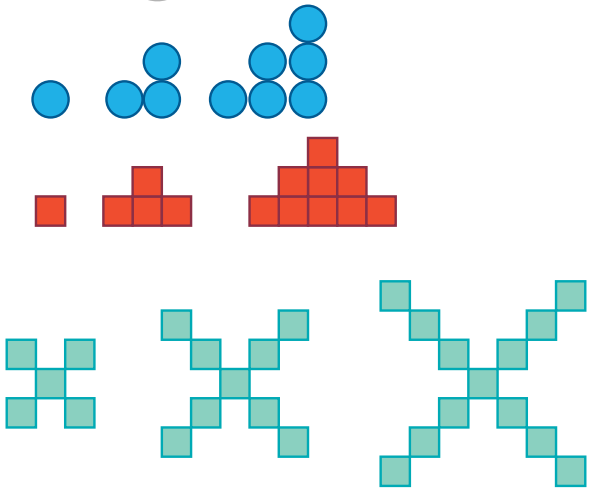
deeper understanding of patterns and also make connections to AI representation and reasoning as following:

- The shaded patterns on the 100 chart can be seen as "features" of the number sequence. In AI, feature extraction is a crucial step where the system identifies key characteristics of the data. Students can discuss what features (like diagonals, steps, or jumps) they see in their shaded patterns.
- The 100 chart itself is a form of data representation, turning abstract number sequences into a structured, visual format. This is similar to how AI systems might represent complex data in structured ways to make it easier to process and analyze.
- After shading part of a sequence, students could predict how the pattern would continue beyond the 100 chart. This is similar to how AI systems use recognized patterns to make predictions.
- By observing the shaded patterns, students can infer the rules behind the sequences. This process is similar to how ML algorithms might infer rules or patterns from training data.
- The grid structure of the 100 chart allows for analysis of how patterns relate to tens and ones, showcasing how underlying mathematical structures can be revealed through appropriate representation—a crucial aspect of AI reasoning.

2. Introduce simple visual patterns (like growing arrangements of dots or shapes, see examples on Figure 6.2) and ask students to describe the structure they see.

   - Students can observe and describe how a pattern grows from one step to the next, such as adding one more square or triangle each

FIGURE 6.2 ● Sample Visual Patterns for Structure Activity (created by the authors using GeoGebra, geogebra.org)



Source: Created with GeoGebra®, by Irina Lyublinskaya. GeoGebra® is a registered trademark of GeoGebra GmbH.

time. This idea of sequential patterns is fundamental to how AI systems learn to predict what comes next in a series.

- Students count the objects in each step of the pattern, discovering skip counting. This relates to how AI systems can be taught to recognize numerical patterns in data.
- Students identify and name the shapes used in the growing pattern, which mirrors basic shape recognition in computer vision, introducing the concept that computers can be taught to identify shapes just like students are learning to do.

Throughout the activity, students draw parallels to how computers, like the students, can be taught to recognize patterns in various types of data. This exploration not only reinforces the students' understanding of arithmetic patterns but also introduces them to AI's core concepts of representation and reasoning.

BIG IDEA #3: LEARNING

In this high school algebra lesson, students predict a person's shoe size based on their height. They collect and analyze height–shoe size data, make sense of the problem, plan solution pathways, and persevere through challenges in finding a line of best fit. By comparing their manual approach to calculator-generated linear regression, students experience how humans and machines can learn from data to make predictions.

6.4 Lesson: Line of Best Fit

For High School

MP1. Make sense of problems and persevere in solving them.

Students who are mathematically proficient start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem to gain insight into its solution. They