Nature's Codebreakers: an unplugged family adventure – part 1

By European Parents' Association – EPA

Objectives

Using the example of patterns in nature to introduce concepts of coding in an unplugged way, i.e. without the use of devices, to foster computational thinking and problem solving skills.

Duration

60 min – 2 hrs

Target group

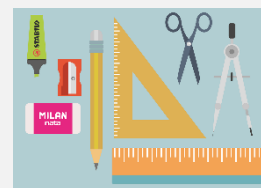Different ages for different missions

Experience

Beginner

Materials

Paper and pencil, magnifying glass, camera for documentation, bag or basket to collect materials, outdoor clothing

Description

Introduction

At its heart, computer science is about identifying, analysing, and implementing patterns to solve problems or create systems. Algorithms are sequences of steps: Many natural phenomena follow predictable sequences or cycles, which can be seen as real-world algorithms. Think of the steps a seed takes to grow into a plant, or the way a spider builds its web.

Thinking about patterns in nature as a form of "unplugged coding" is a fantastic way to introduce computational thinking skills in your family without relying on computers. The following activities are designed to spark curiosity and coding skills in your littlest explorers or your grown-up adventurers.

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Part 1: The basics

So now get ready to become Nature's Codebreakers! We're about to embark on an exciting adventure right in your backyard, local park, or even on a nature walk. Our mission? To uncover the secret codes hidden all around us – the amazing patterns of nature! Just like computer programmers use patterns to build amazing things, nature uses them to create its own wonders. So, put on your explorer hats, open your eyes wide, and let's crack the code!

> **What skills will your child develop in this section?**

Pattern Recognition: Identifying patterns is a core skill in programming. Debugging, for instance, often involves recognizing patterns of errors. In nature, recognizing patterns like the spiral arrangement of leaves, or the hexagonal structure of a honeycomb, helps us understand underlying rules.

Decomposition: Complex natural patterns can often be broken down into simpler, repeating elements. This mirrors the coding concept of breaking down a large problem into smaller, manageable subroutines or functions.

Abstraction: When we focus on the underlying pattern in nature (e.g., a repeating spiral), we are abstracting away from the specific details of the object (a pinecone vs. a sunflower). Abstraction is crucial in coding for creating flexible and reusable solutions.

Mission 1: The Great Pattern Hunt! (all ages)

Calling all detectives! We need your sharpest eyes to find repeating patterns in nature. A pattern is something that repeats itself in the same way, over and over.

Your Challenge: Grab your grown-up and head outside. Your mission is to find as many different types of repeating patterns as you can. Here's a secret agent checklist to get you started:

- **Repeating Shapes:** Can you find leaves with the same shape repeating on a stem? What about the petals of a flower?
- **Spiral Wonders:** Look closely at pinecones, sunflowers, or even the way some vines grow. Do you see a swirling pattern? That's a spiral!
- **Branching Out:** How do the branches of a tree grow? Do you see a pattern in how they split and grow smaller? Look at the veins in a leaf, too!
- **Colourful Sequences:** Can you spot a pattern of colours in a row of flowers or the rings on a tree trunk?
- **Symmetrical Secrets:** Find things that look the same on both sides, like a butterfly's wings or some leaves. That's symmetry!

Codebreaker Tip for Little Explorers:

Focus on one type of pattern at a time. "Let's find all the round things today!" or "How many things with pointy edges can we discover?"

Codebreaker Challenge for Junior Agents:

Try to describe the pattern you find using words. For example, "I see a pattern of red flower, then yellow flower, then red flower again.

Codebreaker Quest for Master Minds:

Can you draw the pattern you found? Or even try to predict what might come next in the pattern?

Debrief:

Once you're back at base camp, share your discoveries! What were the coolest patterns you found? Did you notice any patterns that were tricky to spot?

Fractal spirals: Romanesco broccoli showing self-similar form

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Mission 2: Nature's Step-by-Step Stories!

Did you know that many things in nature follow a set of steps, just like a recipe or a set of instructions for a computer? These are like nature's very own algorithms!

Your Challenge: Choose something in nature that changes over time. It could be:

- **A blooming flower:** What are the steps it goes through from a bud to a full bloom?
- **An ant finding food:** What are the steps the ant takes?
- **A puddle drying up on a sunny day:** What happens first, second, and so on?

Codebreaker Tip for Little Explorers:

Focus on the "What happens next?" question. "First the seed is in the ground, then what?"

Codebreaker Challenge for Junior Agents:

Try to draw a picture story showing the steps you observed. Use arrows to show the order.

Codebreaker Quest for Master Minds:

Can you write down the steps you observed as a numbered list? That's like writing your first algorithm!

Debrief:

Talk about the order of events. Could any of the steps happen at the same time? What would happen if one of the steps was missing?

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Mission 3: Building with Nature's Blocks!

Just like programmers use blocks of code to build programs, nature uses its own "building blocks" to create amazing structures.

Your Challenge: Gather some natural materials like leaves, twigs, stones, and flowers (remember to be gentle and only collect things that have fallen to the ground!).

Your Task: Use these natural blocks to create your own patterns!

- **Simple Sequences:** Can you make a line of leaf, then stone, then leaf, then stone?
- **Repeating Shapes:** Can you arrange twigs to make repeating triangles or squares?

Your Own Code! Once you've created a pattern, try to "code" it by describing the sequence of elements you used. For example: "Big leaf, small stone, red flower, repeat two times."

Codebreaker Tip for Little Explorers:

Focus on making a simple repeating line with two or three different materials.

Codebreaker Challenge for Junior Agents:

Try to create a more complex pattern with more elements and repeat it several times.

Codebreaker Quest for Master Minds:

Can you create a pattern and then give instructions to someone else to build the same pattern without them seeing it? That's like giving instructions to a computer!
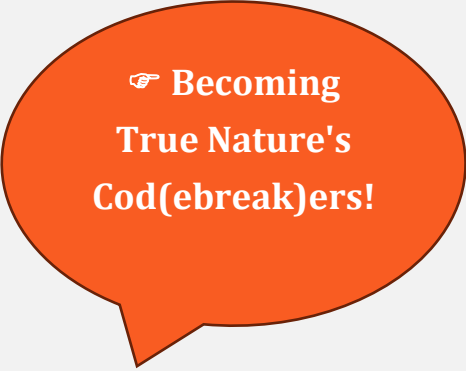
Debrief:

What were the easiest and hardest patterns to build? How is building with nature's blocks similar to building with LEGOs or other construction toys?

By exploring the patterns and processes in nature, you're already thinking like a coder! You're learning to observe carefully, identify sequences, break down complex things into smaller steps, and even create your own "natural code." Keep exploring, keep questioning, and you'll discover that the world around us is full of amazing codes waiting to be cracked!

We wish you happy Cod(ebreak)ing!

☞ **Becoming True Nature's Cod(ebreak)ers!**

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