

# FIBONACCI NUMBERS IN NATURE

Nature's Sequential Patterns

Betsy Irwin

## Teacher's Guide

Winter Program: Fibonacci Numbers in Nature

Grade Level: Fourth – Sixth Grade

Program Length: 1 hour

### INTRODUCTION

Math, science, and art combined around 1200 for a young man named Leonardo Pisano Bogello Bonacci. As a young boy, he became very interested in mathematics when traveling with his father to North Africa to help with their trading post. There he learned of the Hindu-Arabic numbering system which was far more efficient and simpler than the Roman numerals he had learned as a student in Italy. Leonardo Fibonacci (son of Bonacci) introduced Europe to Arabic numerals and the sequence of repeating numbers often seen in nature. Nature's number sequence of patterns was known to Indian mathematicians and scientists as early as the 6<sup>th</sup> century, but it was Fibonacci's book, *Liber Abaci*, that introduced it to Western civilization in 1202 AD. Students are introduced to these repeating patterns in nature through real life examples, photos, a sorting game, an interactive discussion, and a simple art project.

### OBJECTIVES:

1. To become familiar with the history of mathematics and science integration through the studies of Leonardo Fibonacci.
2. To observe and examine real life examples of nature that demonstrate the repeating patterns now know as Fibonacci numbers.
3. To create an art project based on Fibonacci numbers in nature.
4. To gain a better appreciation for the beauty and infinite wisdom of the natural world.

**THIS PROGRAM HAS THE POTENTIAL TO MEET THE FOLLOWING ILLINOIS STATE STANDARDS:**

Learning Area	Goal	Standard	Benchmark
Language Arts	4	A	1a, 1b, 2a, 2b
Language Arts	4	B	1b, 2b
Mathematics	6	A	1a, 2

Mathematics	6	B	1, 2
Mathematics	8	A	1a, 2a
Science	11	A	1a, 1b, 2a, 2b, 2c
Science	11	B	1a, 2a
Science	12	A	1b, 2b
Science	12	B	1a, 1b, 2a, 2b
Social Sciences	18	A	1, 2, 3
Fine Arts	26	B	1d, 2d

### SUGGESTIONS FOR PRETRIP ACTIVITIES

1. Ask students to research Fibonacci and bring their disparate facts together for an initial discussion of the importance of learning more about Fibonacci numbers. Students may find with an internet search that Fibonacci numbers are used a great deal by stockbrokers in predicting capital markets and that artists have been using the Golden Rule (defined by Fibonacci numbers) for artwork since the times of the Renaissance Period.
2. Introduce the Fibonacci sequence of numbers as the sum of the two previous numbers, starting with 0 and 1. The sequence begins 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, etc. Make a series of math problems for the students based on the sequence.
3. Take a walk about the schoolyard or neighborhood to look for the Fibonacci patterns of numbers in nature. Make a graph or a class art poster to depict findings.
4. Share any of the book identified in the Resource List at the end of this Teacher's Guide with the students for a discussion or a basis for other sequential nature numbering activities.

### DESCRIPTION OF LINCOLN MEMORIAL GARDEN PROGRAM

The program begins with a brief introduction to the fascinating world of Fibonacci through an interactive discussion. Through viewing posters, photos, and natural objects in small groups, students are introduced to Fibonacci numbers. Nature's artistic and predictable numbering system is observed in leaf arrangements, flower petal patterns, bracts of a pinecone, scales of the pineapple, spiraling sunflower seed heads, nautilus shells, and even a beehive. Following the sorting games and

observational activities, students are given the opportunity to create an art design based on Fibonacci numbers.

### SUGGESTIONS FOR POST TRIP ACTIVITIES

1. Use the art project that was begun with the in-school program as a springboard for a class art show based on Fibonacci nature numbers.
2. Study nutrition and nature by making observations of many vegetables and fruits that follow the Fibonacci numbering patterns. Count cauliflower and broccoli spiraling heads, scales spiraling on pineapples, apple seed patterns of five, leaf arrangements of lettuces, sunflower seedhead spirals, etc. After carefully counting the number patterns, rinse the veggies and fruits and make a healthy snack for the “natural mathematicians” in the class.
3. Take a walk about the schoolyard, neighborhood, or schedule a field trip to a natural area – maybe even Lincoln Memorial Garden. Hike with Fibonacci numbers in the forefront of the mind to see just how many plants in nature seem to show us the Fibonacci sequence numbers.
4. Read and share with the class any of the books found in the Resource List of the Teacher’s Guide for further reinforcement and study.

### RESOURCE LIST FOR FIBONACCIN NUMBERS IN NATURE:

#### Nature’s Sequential Patterns

Benjamin, Arthur T. and Quinn, Jennifer J. *Proofs that Really Count: The Art of Combinatorial Proof*. Dolcini Mathematical Expositions: The Mathematical Association of America, Inc. 2003

Brown, Constance. *Fibonacci Analysis*. Aerodynamic Investments, Inc.: Bloomberg Press. 2008

Engelberg, Kathleen. *Fibonacci Numbers in Nature*. Scientific Education: Addison-Wesley Publishers. 1986

Engelberg, Kathleen. *Fibonacci Numbers in Nature* poster. Scientific Education: Addison-Wesley Publications. 1986

- Garland, Trudi H. *Fibonacci Numbers in Nature*. Dale Seymour Publications. 1986
- Garland, Trudi H. *Sequence in Nature* poster. Jensen Scientific Publications.
- Garland, Trudi H. *Math and Music: Harmonious Connections*. Dale Seymour Publications. 1995
- Garland, Trudi H. *Fascinating Fibonacci's Mystery and Magic in Numbers*. Dale Seymour Publications. 1987
- Garland, Trudi H. *Fibonacci Fun: Fascinating Activities with Intriguing Numbers*. Dale Seymour Publications. 1997
- Hulme, Joy N. *Wild Fibonacci: Nature's Secret Code Revealed*. Tricycle Press. 2005
- McCallum, Ann. *Rabbits, Rabbits Everywhere: A Fibonacci Tale*. Charles Bridge Publishers. 2007
- Olsen, Scott. *The Golden Section: Nature's Greatest Secret*. Wooden Books. 2006
- Posamentier, Alfred S. and Lehmann, Ingmar. *The Fabulous Fibonacci Numbers*. Prometheus Books. 1987
- Dr. Stella. *Fibonacci Sequence* song from the album, *People of the Earth* (mp3 download)
- Stewart, Ian. *Nature's Numbers: The Visual Reality of Mathematics*. Peseus Books Group. 1997
- Stewart, Ian. *Life's Other Secret: The New Mathematics of the Living World*. John Wiley & Sons, Inc. 1998
- Vorobiev, Nicolai N. *Fibonacci Numbers (originally titled Chisla Fibonacci)*. Russian Academy of Mathematics: Nauka Moscow. 1992

