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## SECTION 1

# CHAOS THEORY



**T**he first six chapters present six chaos theory principles and their implications for brain-compatible science. Chaos means order without predictability or persistent instability. The science of chaos, a significant mathematical development of the twentieth century, presents a random and unpredictable world with systems that change over time. The world evolves in cycles as energy transforms matter into self-similar patterns. Systems that look chaotic have a deeper order within. The mind/brain principles proposed by Renate and Geoffrey Caine (1991) aid teachers in reconceptualizing science education by removing teachers from their traditional paradigms and guiding them to redefine science education for a nonlinear and much more complicated future world.

## IMPLICATIONS OF CHAOS THEORY PRINCIPLES FOR SCIENCE EDUCATION

### **Fractals**

Wait for simple truths to reveal greater complexities.  
Construct new meaning from the old.  
Search for repeating patterns and different perspectives.

### **Iteration**

Emphasize dynamic process and flexibility.  
Look for similarities in systems.  
Feed new information into the system.

### **Sensitive Dependence on Initial Conditions**

Pay attention to details.  
Show sensitivity to unique dynamics.

### **Strange Attractors, Phase Space, and Phase Portraits**

Trust in the inherent order.  
Set invisible boundaries with freedom to expand.  
Provide greater freedom and flexibility.  
Believe in the power of guiding principles and values.

### **Bifurcation and Period Doubling**

Recognize more than one right way by providing choices.  
Seek out turmoil and surprise.  
Provide a joyful classroom atmosphere.

### **Turbulence**

Expect the order to reemerge.  
Loosen up and have some fun.  
Let go of the control to keep it.