ALGEBRA: INTO THE UNKNOWN

An Interactive Unit that Incorporates Activities Promoting Algebraic Thinking and Reasoning

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The nationwide movement for high standards has not only determined what students should learn, but also has mandated that students demonstrate what they know. Teachers who choose INTO THE UNKNOWN will find it is a standards-based program addressing many National Mathematics Standards. What makes INTO THE UNKNOWN especially effective is that it not only targets most state frameworks for problem solving and computation, it also specifically addresses algebra at the elementary level. INTO THE UNKNOWN provides many opportunities for both written and observational performance assessment. Students, working in pairs called Math Mates, demonstrate their understanding of equations, patterns, functions, and variables as they solve problems. They use writing to explain how they arrived at an answer and to clarify their thinking. As a culminating activity students become Algebra Architects and apply what they have learned about algebra to construct an underwater research center. The peer-teaching and cooperative problem solving required in INTO THE UNKNOWN also addresses Applied Learning standards.

NATIONAL STANDARDS FOR SCHOOL MATHEMATICS

Number and Operations Standard
- Understand numbers, ways of representing numbers, relationships among numbers, and number systems
- Understand meanings of operations and how they relate to one another
- Compute fluently and make reasonable estimates

Algebra Standard
- Understand patterns, relations, and functions
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships

Problem-Solving Standard
- Build new mathematical knowledge through problem solving
- Solve problems that arise in mathematics and in other contexts
- Apply and adapt a variety of appropriate strategies to solve problems
- Monitor and reflect on the process of mathematical problem solving
Communication Standard

- Organize and consolidate their mathematical thinking through communication
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
- Analyze and evaluate the mathematical thinking and strategies of others
- Use the language of mathematics to express mathematical ideas precisely

CALIFORNIA APPLIED LEARNING STANDARDS

Standard 3: Students will understand how to solve problems through teaching and learning. Students will develop and implement a teaching-learning program.

Standard 6: Students will understand how to apply communication skills and techniques. Students will demonstrate ability to communicate orally and in writing.

Standard 8: Students will understand the importance of teamwork. Students will work on teams to achieve project objectives.
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INTO THE UNKNOWN explores the world of algebra for young learners grades 2–4. It is important to recognize algebraic thinking as it emerges at the elementary level and to structure real situations that encourage children to use symbols to represent patterns and relationships. Algebra helps students develop essential ways of thinking, interpreting, and understanding situations in daily life.

Familiarizing young learners with equations, variables, and patterns and functions establishes the foundation for understanding “the unknown.” A variety of activities tap into the students’ capacity to learn through pictures and symbols. Students gain confidence in their mathematical abilities by practicing algebraic skills and applying them to problem-solving strategies. Using algebraic reasoning provides a rich context for advancing mathematical understanding and promotes success in the formalized study of algebra at higher levels.

Specifically, your students will experience the following:

Knowledge
- Identify equations and equalities
- Understand the concepts of unknowns and variables
- Understand various types of patterns
- Comprehend functional relationships
- Analyze change in both real and abstract contexts
- Learn new strategies for solving problems

Skills
- Understand how to solve equations that use unknowns
- Identify, analyze, and extend patterns
- Describe how both repeating and growing patterns are generated
- Represent and record patterns using tables and graphs
- Use mathematical models
- Utilize symbolic form to represent mathematical situations
- Identify and describe relationships between two quantities that vary together
- Write to explain their thinking

Attitudes
- Develop a sense of the relevance for algebraic thinking
- Recognize the need for examining patterns in an organized way
- Form a positive attitude toward math
- Build self-confidence in ability to use algebra
INTO THE UNKNOWN introduces basic algebraic concepts including equations, variables, and patterns and functions. Students learn algebraic language and practice basic math operations while investigating algebra in an ocean environment. The purpose of their exploration is to reach the ocean floor where they build an underwater research facility. The sea theme provides motivation and continuity as students learn how to display mathematical relationships through symbols, diagrams, tables, and graphs.

Students begin INTO THE UNKNOWN by taking a Pretest to gauge their understanding of basic algebra. Over a three-week period, student pairs or “Math Mates” examine elementary algebraic concepts, one concept per week. Each Sea Depth (or phase) consists of discrete lessons and assessment of that week’s concept. As Math Mates successfully complete their activities, they progress through three levels of accomplishment (Aquatic Investigators, Diving Detectives, and Sea Sleuths), earn “Sand Dollars,” and move closer to their goal—the bottom of the ocean!

Follow-up Learning Lab activities for each area of study reinforce the concept of the week and the topic of each day. Students may do one or more of the Learning Labs per phase as a follow-up to whole class learning at the end of the week or they may be rotated through all of the labs after the completion of the Sea Depths.

As a culminating activity, students apply what they have learned about algebra to construct an underwater research center. Students become Algebra Architects as they build a facility from cubes purchased with Sand Dollars they earned throughout the unit. Upon completion of their structures, students write a letter to Mr. Rip Tide, Chief Oceanographer, to explain the function of their underwater research center. The unit ends with a research station presentation and an INTO THE UNKNOWN party!
1. **Before You Begin**
   Carefully read INTO THE UNKNOWN in its entirety to become familiar with its elements, formats, and procedures. Plan your time and adjust this unit to meet your students’ needs and abilities.

2. **Prepare Your Classroom**
   Developing an ocean environment will enhance the atmosphere of the unit.
   - Display the INTO THE UNKNOWN CHART prominently in your classroom. Use this chart as a large-scale gameboard. Leave space around the chart to display student activities and projects created during the unit.
   - Before you begin the unit provide each pair of students with a submarine (template on page 17) to decorate as their movable marker.
   - Collect books about the ocean, sea creatures, and submarines. Make them accessible to students during their free time.
   By the end of the unit, your entire classroom could be submerged Into the Unknown!

3. **Timing**
   Each lesson will take approximately one hour each day for three weeks—one week for each Sea Depth or phase. The final day(s) of the unit concludes with the culminating activity.

4. **Grouping Students**
   Divide your class into pairs or Math Mates. Encourage each pair to choose a sea-related name. Each day students work with their Math Mate following whole class instruction. Every lesson ends with individual work time.

5. **INTO THE UNKNOWN Folders** (Optional)
   To help your students organize their work for this unit, use pocket folders to keep all of their INTO THE UNKNOWN activities, Water Logs, and Sand Dollars. You may give a pocket folder to each student or create folders using a large piece of construction paper.