



AFT EDUCATIONAL RESEARCH AND DISSEMINATION COURSE OVERVIEW

Course: Thinking Mathematics Middle School: Journey to Algebra

Summary

This course has no prerequisites. It is a stand alone course. Because students who arrive in middle school struggling with mathematics are usually missing some basic concepts, this course incorporates content from other Thinking Math courses but stretches both the research (which is not plentiful) and examples to middle school level. Units on Patterns and Relationships, Number Sense, Additive and Multiplicative units take each concept from whole numbers through fractions, negative numbers, and algebra. The final two-day unit is on beginning algebra. Because of the amount of mathematics covered, this is a 7-day course.

Course Content

Introduction and Ten Principles. This unit summarizes the research findings behind the Ten Principles of Thinking Mathematics and connects them to the five strands of mathematical proficiency as defined by the National Research Council. It also examines the learning needs of middle and high school students and released problems from TIMSS and PISA.

Patterns and Relationships. Since patterns and relationships are fundamental to all mathematical activity, this unit highlights some commonly recurring patterns. It stresses the importance of pattern recognition and understanding relationships to students' problem solving success and their connection to algebra.

Number and Number Sense. This unit focuses on understanding what number sense is and ways to help its development. The unit begins with understanding whole numbers and the importance of being able to compensate, decompose, and recompose them in many ways to make computation easier. It examines how to help students use benchmarks to understand relative magnitude of common and decimal fractions. It highlights aspects of fractions that confuse students, looks at representations that might be helpful and activities to develop a sense of whether answers are reasonable.

Unit 4. Additive Structure. This unit stresses the need for students to understand word problems rather than relying on "key words." It focuses on multiple representations and how to move students from the concrete to semi-concrete, semi-abstract and the abstract. Whole number, fraction, and negative

number situations are included. The unit closes with a case study in which students enter a problem at different levels.

Multiplicative Structures. This unit makes explicit differences between additive and multiplicative structures that are usually not made clear to students. It highlights the value of arrays and area models, illustrating how similar strategies can be used with whole numbers, fractions, decimals, and even in algebra. The model is linked to traditional algorithms. Division is approached from a sense-making perspective. Proportion and multiplicative growth are addressed.

Algebra. This unit establishes the role of pattern recognition in solving problems. It addresses guiding students to record and generalize their observations. Using geometry as a starting point, participants explore helping students understand linear functions and rate of change with stress on helping students link various ways of seeing the same image (problem). There is a brief look at systems of equations, quadratics, and translation from word problems to expressions and equations.

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