Using Patterns to Develop Algebraic Thinking
Course Syllabus

Catalog Description

In this workshop for middle school teachers of mathematics, participants will explore the nature of algebraic thinking and develop strategies for encouraging the development of algebraic thinking in their students. Through readings, video clips, and examination of student work, participants will learn to: 1) recognize and build on opportunities for algebraic thinking in a variety of mathematics contexts; 2) analyze their students' algebraic thinking; and 3) pose questions that encourage the development of algebraic thinking. Participants will also produce a lesson plan that incorporates the key concepts of the workshop.

Prerequisites

Participants are expected to have regular access to computers. In addition, participants should be proficient with using email, browsing the Internet, and navigating to computer files.

Goals

This workshop will enable participants to:

- Develop an understanding of mathematical and algebraic thinking
- Recognize and build on opportunities for algebraic thinking in a variety of mathematics contexts
- Analyze students' algebraic thinking
- Pose questions that encourage the development of algebraic thinking

Assessment and Course Requirements

Each session includes readings, an activity and a discussion assignment, which participants are required to complete.

Course Products
As a final product, participants will create a lesson plan based on the strategies and concepts they have explored throughout the workshop.

Discussion Participation
Participants will be evaluated on the frequency and quality of their discussion board participation. Participants are required to post a minimum of two substantial postings each session, including one that begins a new thread and one that responds to an existing thread. Postings that begin new threads will be reviewed based on their relevance, demonstrated understanding of course concepts, examples cited, and overall quality. Postings that respond to other participants will be evaluated on relevance, degree to which they extend the discussion, and tone.

Required Readings, Activities and Assignments

Session One: What is Algebraic Thinking?

Participants will read:

- *Algebraic Thinking, According to Some Experts* by Shirley Kriegler
  http://www.edtechleaders.org/documents/Patterns/definitions.pdf
- *Chapter One of "Fostering Algebraic Thinking"* by Mark Driscoll
  http://www.edtechleaders.org/documents/Patterns/DriscollPart1.pdf

In this session's activity, participants will solve the "Crossing the River" algebra problem, paying attention to their mathematical strategies and taking notes about them.

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Session Two: Exploring Algebraic Thinking in Patterns – Examining Your Own Thinking

Participants will read:

- *Patterns as Tools for Algebraic Thinking* by Kirsten Herbert and Rebecca Brown
  http://www.edtechleaders.org/documents/patterns/PatternsasTools.pdf

Participants will explore the "Painting Faces" problem and reflect on their own thinking, as a starting point for examining student thinking in later sessions.

Session Three: Analyzing Students' Algebraic Thinking about Patterns

Participants will read:

- *Using Students' Work as a Lens on Algebraic Thinking* by Mark Driscoll and John Moyer
  http://my.nctm.org/eresources/view_media.asp?article_id=536

Participants will study two examples of student work and look for evidence of algebraic thinking in each. They will subsequently watch two videos in which the students explain their thinking processes as they worked on the problem.

Session Four: Using Teacher Questioning to Explore Algebraic Thinking

Participants will read:

- *Never Say Anything a Kid Can Say* by Stephen Reinhart
  http://www.edtechleaders.org/documents/patterns/neversay.pdf

Participants will solve the "V-Patterns" problem independently, noting their own approach to the problem. They will then watch four video clips in which a classroom teacher poses questions about the "V-Patterns" problem to students, and consider which questions effectively elicit algebraic thinking from the students.

Session Five: Conducting a Student Interview

Participants will read:

- *Chapter Five of "Fostering Algebraic Thinking"* by Mark Driscoll
  http://www.edtechleaders.org/documents/patterns/Driscollch5pt1.pdf

Participants will solve the "Tiling Garden Beds" problem, and then interview two students to learn about their thinking and their ability to generalize in their solution to the "Tiling Garden Beds" problem.

Session Six: Developing a Lesson Plan on Patterns and Algebraic Thinking
Participants will use the Algebraic Thinking Lesson Plan Template to design a lesson plan incorporating what they have learned about analyzing students' mathematical thinking and developing good questions.

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