Title

Patterns and Relations: Algebra Concepts for Grades 1-5

Target Audience

This course is intended for pre-service and in-service teachers of grades 1-5

Facilitator

See instructor/facilitator sheet

Credits

TBA

Course Description

This course is designed to help elementary school educators understand the role and importance of patterns and relations in mathematics, as well as the NCTM expectations for students. In this course, learners will explore lesson plans, investigate problem situations, solve problems, and examine Web resources. Learners will examine different types of patterns using manipulatives and technology that involve constructing and describing patterns, conjecturing, and generalizing. Activities that introduce and use a pictorial language of arrows for relations will be incorporated in problem-solving strategies, numerical relations, and patterns to further develop algebraic thinking concepts.

As a final project, the learner will develop and implement a lesson or series of lessons that integrate technology, manipulatives, and effective pedagogical strategies that will be ready for immediate implementation in the classroom. These ready-to-use lesson plans will promote the vision of the NCTM Algebra and Representation Standards. The learner will also write a reflection paper documenting the results of implementation—what was effective, observations of students, student work samples, student comments on the learning experience, and assessments—and will have the opportunity to collaborate online with other learners to improve the lesson.

Goals and Objectives

Learners will:

- Understand the importance and the roles patterns and relations play in elementary school mathematics
- Understand expectations of students in grades 1-5, specific to patterns and relations, as suggested by the NCTM Principles and Standards for School Mathematics
- Learn how to use pattern contexts and the pictorial language of arrows for relations
- Increase understanding of ways to integrate the following into classroom practices: manipulatives, technology, and effective strategies to teach patterns and relations

Part 1: Understanding Patterns and Relations

Learners will:

Reflect on prior knowledge and understandings of the role and importance of patterns and relations in elementary school mathematics.

- Respond to question: "What role and importance do you see patterns and relations playing in your teaching (or the mathematics curriculum) of elementary school mathematics?"
- Describe a problem situation where you would expect to use patterns and/or relations in the solution.
- Go to the Discussion Board and identify one aspect of the conversation that reminds you of your own experience. Share that experience by posting to the Board. Comment on some connections between your experiences and those of fellow learners.

Read

- "1989 Curriculum and Evaluation Standards"
- "K - 4 Standard 13: Patterns and Relationships"
- "5 - 8 Standard 8: Patterns and Functions"
- "Principles and Standards for School Mathematics, Algebra Standard"
- "Algebra Standard for PreK-2"
- "Algebra Standard for Grades 3-5"

Participate in the online discussion

After completing the readings, learners will respond to at least one of the following questions:

- What ideas or examples in the readings did you find particularly important or interesting?
- How would you use some of the examples in lesson planning?
- How can technology assist teachers in developing concepts related to patterns and relations?

Participate in the online discussion

Comment on connections between your observations and those of fellow learners.

Record in the online journal

Note ideas and examples about NCTM standards' of patterns and relations, and about how manipulatives and technology can assist teachers in working with students on finding, describing, and using patterns and relations.

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Part 2: Review Lesson Plans for Patterns

Learners will:

Review lesson plans

- The Magic Box
- Illuminations Lesson Plan Series: Creating, Describing, and Analyzing Patterns to Recognize Relationships and Make Predictions

Watch the video

- "The Magic Box" (Videos 1, 2, and 3)
- "Annenberg"

Investigate a pattern context

- Participate in an activity with the "Tables and Chairs" story context for investigating with patterns.
- Make, describe, explain, and predict with the patterns in this storycontext, answering questions and solving problems.
- Examine other arrangements of the tables and chairs to find, describe, and predict patterns.

Read

- "Algebraic Thinking: Readings from NCTM's School-Based Journals and Other Publications—Classroom Activities"
- "Experiences with Patterning"

Examine technology enhancements for lessons on patterns

- Color Patterns and Number Patterns
- Pattern Generator
- Number Pattern Grids
- Calculators and Number Patterns
- Learning about Number Relationships and Properties of Numbers Using Calculators and Hundred Boards: Displaying Number Patterns
- Spreadsheets
    - Spreadsheet Basics
    - Locker Problem Activity

Participate in the online discussions

After completing this part of the course, go to the Discussion Board and post responses to the following:

- How does the sequence of activities in The Magic Box lesson compare to the four parts of the Illuminations lesson plan series? Using these lessons, what would you look for in students to meet the expectations of the NCTM standards with respect to understanding patterns? How would you provide feedback to students who were not meeting expectations?
- After completing the tables and chairs activity, participants describe a different arrangement of tables and chairs and explain how you found patterns or a way to determine for any number of tables the corresponding number of chairs.

Record in online journal

- Using the "Tables and Chairs" context and the presentation in the paper "Experiences with Patterning," note the interest and algebraic reasoning of students at different levels (1-2, 3-4, and 5-6) with these contexts. Note as well how to use the activities in developing a process of looking for patterns, recognizing patterns, extending patterns, and predicting or generalizing patterns to solve problems.
- After exploring the Web-based technology enhancements, note what is effective, how they might be used to plan worthwhile instructional tasks, and what adaptations you would make (positive and negative features) on at least two of these tools.

Part 3: Develop a Language of Arrows for Relations

Learners will:

Read

- Representation Standard
- Representation Standard for Grades PreK-2
- Representation Standard for Grades 3-5

Investigate relations with a language of arrows

- Read lessons that introduce the language of arrows:
  - Clowns
  - Telling Stories for an Arrow Picture
  - Number Friends

- Complete an activity with arithmetic relations
  - +3 Arrow Roads Activity

Solve problems with relations

- Fishing for Numbers problem
- Who is Sam? problem
- 2x and +1 Arrow Road problem
- Arrow Roads
- Math Mountain problems

Examine technology enhancements for lessons on relations

- Number Cruncher
- Number Line Bounce
- Spreadsheets
  - Using Spreadsheets in Mathematics Education (ERIC Digest)
  - Creating a spreadsheet with X-Y data
  - What's My Rule?
  - Guess the Rule

Participate in online discussions

Upon completion of the readings and assignments, learners will use the Discussion Board to comment on:

- The language of arrows for relations as a representation to organize, record, and communicate mathematical ideas
- How students' representations help them communicate mathematical understandings
- How you can use representations to assess students' understandings

Record in online journal

- Describe your reasoning in solving two problems: "Fishing for Numbers" and "2× and +1 Arrow Road." Post your response on the Discussion Board and compare your reasoning to that of other learners.
- Record your solutions and create other similar problems that would be at an appropriate level for your students. Consider how your students would approach these similar problems.
- After exploring the Web-based technology enhancements, note what is effective, how they might be used to plan worthwhile instructional tasks, and what adaptations you would make (positive and negative features) on at least two of these tools.

Part 4: Review Web Resources for Patterns and Relations

Learners will:

Review a lesson plan:

- Peddling Petals

Watch the video

- Peddling Petals (Videos 1, 2, and 3)

Read

- Guidelines for Evaluating Web Sites
- "The ABCs of Web Site Evaluation"

Explore, review, and evaluate Web resources

- The Annenberg/CPB Teachers' Lab: Patterns in Mathematics
- New Zealand Math's "Algebra Units of Work"
- Creative Classroom Online Math Matters: Algebra in Elementary School
- What's the Function of Patterns and Functions?
- AskERIC Lesson Plans: Find a Pattern with "One Grain of Rice"
- Square Walk (Guess My Rule)
- Patterns to the Rescue
- Rectangle Pattern Challenges

Participate in online discussions

After completing the readings and exploration of Web resources, choose at least two resources to evaluate and explain how the site could be used in planning lessons for your classroom. Review comments on the Discussion Board and share connections between your experiences and those of other learners.

Record in online journal

Reflect on the Peddling Petals lesson, making observations about what you found to be especially effective and what you would change. Consider other contexts (situations) that might be used to accomplish the goals of this lesson.

Part 5: Final Assignment

Learners will:

Complete the following assignment and use the Digital Drop Box in the Student Tools area of the course to submit the project to the facilitator.

- Create a lesson or series of lessons that integrate technology, manipulatives, and effective pedagogical strategies and that promote the vision of the NCTM Algebra and Representation Standards. The lesson(s) should include student learning objectives and assessments for checking for student understanding.
  - Implement the lesson(s), collect student work, and reflect on the results.
  - Write a 2–5 page paper that describes the activities in the lesson(s), what standards/expectations are being addressed, and what materials and strategies are being used. Include in the paper the results of implementation—what was effective, observations of students, student work samples, student comments on the learning experience, and assessments. Also include comments on changes you would make for future use of the lesson(s).
  - Copy your paper to the Discussion Board. Review papers from other learners and provide feedback focusing on suggestions for adaptations—alternatives or improvements, as well as remediation or extension activities.

Schedule

This course is scheduled to take approximately 15-20 hours to complete readings, activities, video, assignments, reflections and a final project.

Requirements

Learners are expected to

- Complete all assignments
- Participate in discussion boards
- Maintain an online journal

Evaluation

Pass/fail upon satisfactory assignment completion, full discussion board participation, and consistent online journal entries

Materials (hardware, software, plug-ins)

Technical Requirements

- Word processor
- Internet service provider
- Email

Academic Dishonesty Policy

To be inserted by university institution only