

GEORGE MASON UNIVERSITY (GMU)  
COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT (CEHD)  
Division of Elementary, Literacy, and Secondary Education

EDPD502.634: Teaching Patterns, Functions, and Algebraic Thinking in Grades K-2  
Fall 2013

September 30, 2013- October 28, 2013

4:30 - 11 7:30p.m.

Kelly Leadership Center, Room 2011

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#### Course Description:

This course focuses on deepening teachers' content knowledge, understanding of students' mathematical learning, and instructional strategies for teaching patterns, functions, and algebraic thinking at Grades K, 1 and 2. The use of manipulatives, technology, and active learning strategies will be emphasized. The instructors will make connections to lessons reflecting best practices and current research in mathematics.

#### Course Purpose and Intended Audience:

The primary focus of this course is to increase both the teachers' content knowledge in the area of patterns, functions, and algebraic thinking, and the pedagogical background needed to teach these concepts effectively in an inquiry-based mathematics classroom.

#### Course Format:

Class meetings will be structured for maximum teacher participation. Each class will include discussions of mathematical topics and readings. The focus of the mathematical content will be based on current research in mathematics. Activities and lessons supporting these concepts will be modeled, practiced, and discussed. At the end of each class, teachers will reflect on their learning through writing.

#### Course Objectives:

- Teachers will increase their own content knowledge of the mathematics they teach at the elementary level.
- Teachers will explore strategies to enhance student understanding of patterns, functions, and algebraic thinking.
- Teachers will integrate technology to expand student understanding.
- Teachers will focus their attention on strategies students use to solve problems.
- Teachers will shift their focus from teacher centered to student centered.

## Required and Supplemental Texts and Readings:

### Required Texts:

*Navigating Through Algebra in Grades PreK-Grades 2nd*, NCTM, 2001.

*Teaching Student-Centered Mathematics, Grades K-3*, John Van de Walle, 2006.

### Supplemental Texts / Readings:

*Developing Mathematical Ideas: Patterns, Functions, and Change*, Deborah Schifter, Virginia Bastable, and Susan Jo Russell, 2008.

*Developing Mathematical Ideas: Reasoning Algebraically About Operations*, Deborah Schifter, Virginia Bastable, and Susan Jo Russell, 2008.

*Young Mathematicians at Work: Constructing Algebra*, by Catherine Twoney Fosnot and Maarten Dolk.

*Lessons for Algebraic Thinking, Grades K-2*, Leyani von Rotz and Marilyn Burns, Math Solutions Publications, 2002

Selected articles pertaining to early mathematics acquisition and instruction from the NCTM publication *Teaching Children Mathematics*.

### Class Requirements, Performance-Based Assessments, Evaluation Criteria, and Grading Scale:

Expectation: University graduate courses expect a minimum commitment of two hours of out-of-class work for each hour spent in the class.

1. Attendance and Class Participation: (5 points per class) Attend and participate in all class sessions. Repeated absences will be reflected in the course grade.
  - a. Expectation: We have much to offer and learn from one another; therefore, active and respectful participation of all class members is crucial to the success of this course. Class discussion and activities cannot be reproduced. Participants in this class must be in attendance and on time for the entire class session in order to actively contribute to the enhancement of each session.
  - b. Note: failure to attend more than 20% of the classes will result in failure (F) in the course.
  - c. Complete all readings for class discussions and participate in all discussions and activities.
2. Article and Chapter Reflections: (10 points each) Read and respond to all reading assignments per week in a two-page paper. All assignments completed outside of class should be sent to an instructor by email as well as printed out and brought to class. Expectation: Reflections will include relevance to the teacher's professional growth, and possible changes in student behavior and mathematical growth that might occur if ideas in the readings are implemented. All points in reflections must be supported informally, by references from the readings. Activities are to be explored independently and noted as part of the reflections.
  - i. At least two pages, double spaced

- ii. Margins should be no wider than 1 inch
- iii. Font size- 12
- iv. Font Type -Times New Roman or Arial

3. Mathematics Problems: (5 points each) Problems will be posed during or at the close of class. These problems are to be solved with all work shown. They will be assigned for homework.
4. BLOG:Class Reflections:(5 points each) A reflection will be written at the close of each class. Reflections will focus on thoughts about mathematics and changes in viewpoints or approaches to teaching mathematics. Observations and thoughts about classroom discussions should also be included. Teachers should anticipate spending at least 10 minutes writing their reflections for every class period.
5. Teacher Share Technology Project:(10 points) Teachers will present to the class a five-seven minute summary of the project applicable to their grade level. The summary will make connections to the algebraic concepts discussed in class.
6. Final Course Reflection: (5 points) Complete a one-page course reflection describing what you have learned from this course and how your instruction will be impacted in the future. Compare and contrast how you *were* teaching pattern, function, and algebraic thinking concepts before to how you *will* teach them now. Include at least one concrete way you plan to incorporate these ideas into your instruction.

#### Formula for Grading:

University graduate courses expect a minimum commitment of two hours of out-of-class work for each hour spent in class.

Expectations for all assignments are as follows:

- All work shows evidence of thinking, understanding, and reflective thought.
- All work will be completed in a timely manner.

A 108-120 points (90%- 100%)

)! 96 – 107 points (80% -89%)

C 84 – 95 points (70% -79%)

F below 84 points (below 70%)

Late assignments will only be accepted the class session following the one where the assignment was due. All assignments must be turned in to an instructor by Friday, November 1, 2013. In case of a class cancellation due to inclement weather, all assignment due dates will be moved forward one week.

## Patterns, Functions, and Change K-2

Class	Date	Topic	Readings/Assignments (Due the following: clas
1.	9/30/13	<p>Course introduction</p> <p>What is Algebraic Reasoning?</p> <ul style="list-style-type: none"> <li>• Student Centered Instruction</li> <li>• Patterns                             <ul style="list-style-type: none"> <li>-Repeating Patterns</li> <li>-Growing Patterns</li> </ul> </li> <li>• Sign up for Teacher Share Presentation</li> </ul>	<p><i>Navigating through Algebra in Prekindergarten-Grade 2, pp 7-29</i></p> <p><i>Patterns, Functions, and Change (PFC) Casebook-Chapter 1, Case 1</i></p> <p><i>Teaching Student-Centered Mathematics-Grades K-3- Chapter 1, pp. 1-15</i></p> <p>Article: <i>Patterns to develop algebraic reasoning (l'CM March, 2011)</i></p> <p>Homework Problem: <i>Staircase Towers</i></p>
2	1017/13	<p>Structuring the Number System</p> <ul style="list-style-type: none"> <li>• Odds and Evens</li> <li>• Rules and Generalizations</li> <li>• Teacher Share Presentations</li> </ul>	<p><i>Navigating Through Algebra: Chapter 1, pp 19-21.</i></p> <p><i>Teaching Student-Centered Mathematics-Grades K-3- Chapter 10, pp. 284-293</i></p> <p><i>Young Mathematicians at Work: Constructing Algebra, Chapter 2</i></p> <p>Article: <i>Developing "Algebra-'Rithmetic' in the Elementary Grades"(l'CM November, 2007)</i></p> <p>Homework Problem: <i>Operating with Odd and Even Numbers</i></p>

3	10/14/13	<p>Linking Algebraic Representations:</p> <ul style="list-style-type: none"> <li>• Describing Change</li> <li>• The Importance of Models</li> <li>• Teacher Share Presentations</li> </ul>	<p><i>Navigating Through Algebra</i>: Chapter 3, pp 57-70</p> <p><i>Teaching Student-Centered Mathematics-Grades K-3</i>- Chapter 10, pp. 293-296, 302-309</p> <p><i>Young Mathematicians at Work: Constructing Algebra</i>, Chapter 4</p> <p>Article: <i>Instructional Strategies for Teaching Algebra in Elementary School (I'CM May, 2008)</i></p> <p>Homework Problem: <i>Representing Algebra: What Would You Choose?</i></p>
4	10/21/13	<p>Manipulatives and Technology to Develop Algebraic Reasoning</p> <ul style="list-style-type: none"> <li>• Equality / Number Balances</li> <li>• Variables</li> <li>• Teacher Share Presentations</li> </ul>	<p><i>Navigating Through Algebra</i>: Chapter 2, pp 38-40; 44-49</p> <p><i>Teaching Student-Centered Mathematics-Grades K-3</i>- Chapter 10, pp. 297-301</p> <p><i>Young Mathematicians at Work-Fosnot/Jacob</i>-Chapter 5</p> <p>Article: <i>Technology to develop algebraic reasoning (I'CM April, 2011)</i></p> <p>Homework Problem: <i>Number Balances</i></p>
5	10/28/13	<p>Promoting Equality and Equity in Algebraic Thinking</p> <ul style="list-style-type: none"> <li>• Cuisenaire Rod games for equality, associative and distributive properties, and variables (<i>Navigating Through Algebra</i>: Chapter 2, pp 38-40; 44-49)</li> <li>• Teacher Share Presentations</li> <li>• Final Reflection Assignment (due to instructors by 1111113)</li> <li>• Article: <i>Promoting Equity Through Reasoning</i> (TCM May, 2010)</li> <li>• Class Evaluations</li> </ul>	

In the event that a class is canceled due to inclement weather, a make-up class will be held on Monday, November 4, 2013.

**WRITTEN CLASS REFLECTIONS ASSIGNMENT  
RUBRIC**

	No Evidence	Partial Evidence	Developing	Accomplished
<b>CRITERIA:</b> Deep reflection on professional growth	No evidence of reflective thought about the effect on professional growth	Little evidence of reflective thought about the effect on professional growth	Some evidence of reflective thought about the effect on professional growth	Complete evidence of deep reflective thought about the effect on professional growth
<b>CRITERIA:</b> Deep reflection on possible changes in student mathematical growth if ideas expressed in class or in readings are implemented	No evidence of reflective thought about effect on mathematical growth of students	Little evidence of reflective thought about effect on mathematical growth of students	Some evidence of reflective thought about effect on mathematical growth of students	Complete evidence of deep reflective thought about effect on mathematical growth of students
<b>CRITERIA:</b> Knowledge of class content and information from readings	No references to any class activities or statements from readings	Few, if any, references to class activities or statements from readings	Some references to class activities or statements from readings	Many references to class activities or statements from readings

## GMU POLICIES AND RESOURCES FOR STUDENTS

- a. Students must adhere to the guidelines of the George Mason University Honor Code (See <http://oai.gmu.edu/honor-code/>).
- b. Students must follow the university policy for Responsible Use of Computing (See <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/>).
- c. Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- d. The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance (See <http://caps.gmu.edu/>).
- e. Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester (See <http://ods.gmu.edu/>).
- f. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- g. The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing (See <http://writingcenter.gmu.edu/>).

## PROFESSIONAL DISPOSITIONS

Students are expected to exhibit professional behaviors and dispositions at all times.

## CORE VALUES COMMITMENT

The College of Education & Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles: <http://cehd.gmu.edu/values/>.

## TEACHERSHARETECHNOLOGYPRESENTATION

Class members will sign up for a five-seven minute presentation that highlights the information from their Teacher Share Assignment.

- Two pages
- 3-hole punched
- E-mailed to instructors by the Monday before your presentation
- Make copies for class members and instructors
- Use bullets when appropriate.

Reference the web address, software, SMART or Promethean resources, Web Quests (more project-based), wikis, or blogs

Mathematical Focus: (related to **algebra** concepts from this class)

Intended Audience: (teachers, students, parents, etc.)

Summary of Technology:

- Important content
- Related SOL for grades K-2
- "Must see" features of site
- Teacher "friendliness"

Reflections: (Your thoughts and point of view on reasons for your recommendations.)

Name=-----

Presentation Date:-----