

**Mathematics in the Elementary School
From an Advanced View**

M S E D 4 2 6

**Northwestern University
School of Education and Social Policy
Fall 2013**

**Wednesday 12:30pm-3:00pm
Annenberg Hall G08**

Dr. Kim Hufferd-Ackles (Instructor)

Course Overview:

This course will help you prepare to teach mathematics in the elementary classroom. We will examine how to teach mathematics so that students will develop a deep and meaningful understanding of the content. We will explore ways to engage students in the process of thinking about mathematics. You will think deeply about some of the central questions in mathematics content and teaching. Your own experiences of seeing central mathematical ideas from different perspectives will open your minds to the possibilities that will arise in your classrooms as students explore them.

As you prepare to be a reflective practitioner, you will build teaching strategies in the following areas:

- Eliciting, assessing, and analyzing student thinking so that you will be ready understand the mathematical thinking of students and respond with next steps.
- Adapting curriculum and designing lessons to elicit and build on student thinking and understanding based on the knowledge you have of your students and classroom.
- Reflecting on practice to improve teaching practices to work toward deep and meaningful understanding of mathematics content on behalf of students.

We will explore the teaching of mathematics from a practical perspective by exploring curriculum, classroom structures, frameworks, resources, and manipulatives. We will engage in reflective practice as we rehearse key aspects of mathematics teaching practices. You will be given opportunities to assess student thinking, adapt curricular goals, design a lesson, and reflect on implementation. Through our work, we will explore number, place value, and operations (addition, subtraction, multiplication, and division) involving whole numbers, fractions and decimals. We hope that through this class, you will develop, and be able to articulate, a vision for elementary mathematics teaching that is supportive of meaningful student learning.

Northwestern Teacher Education Conceptual Framework:

As active participants in the field of education, our candidates will strive for improvement and innovation, based on inquiry that is grounded in reflection and research. The candidates will have

A Vision of Learning that focuses on:

- 1.1 understanding student thinking about the subject matter;
- 1.2 reflection and research as a means of learning;
- 1.3 Learning as social practice, which encourages collaborative learning in which people clarify doubts, examine beliefs and work together to address questions and concerns;
- 1.4 authentic experience, where class sessions and assignments are designed to engage students' interests and to have implication for the student beyond the classroom; and
- 1.5 the use of technology to extend learning opportunities and thinking.

A Vision of Learners that focuses on:

- 2.1 lifelong learning and development shaped by social contexts; and
- 2.2 student diversity as a resource for the educational community.

A Vision of Teaching that focuses on:

- 3.1 Connecting theory to practice, where the candidates understand that theories suggest questions and ideas about practice, and practice suggests modification of theory; and
- 3.2 professional conduct that is responsible and ethical.

Illinois Professional Teaching Standards, 2013:**1 Teaching Diverse Students**

The competent teacher understands the diverse characteristics and abilities of each student and how individuals develop and learn within the context of their social, economic, cultural, linguistic, and academic experiences. The teacher uses these experiences to create instructional opportunities that maximize student learning.

2 Content Area and Pedagogical Knowledge

The competent teacher has in-depth understanding of content area knowledge that includes central concepts, methods of inquiry, structures of the disciplines, and content area literacy. The teacher creates meaningful learning experiences for each student based upon interactions among content area and pedagogical knowledge, and evidence-based practice.

3 Planning for Differentiated Instruction

The competent teacher plans and designs instruction based on content area knowledge, diverse student characteristics, student performance data, curriculum goals, and the community context. The teacher plans for ongoing student growth and achievement.

4 Learning Environment

The competent teacher structures a safe and healthy learning environment that facilitates cultural and linguistic responsiveness, emotional well-being, self-efficacy, positive social interaction, mutual respect, active engagement, academic risk-taking, self-motivation, and personal goal-setting.

5 Instructional Delivery

The competent teacher differentiates instruction by using a variety of strategies that support critical and creative thinking, problem-solving, and continuous growth and learning. This teacher understands that the classroom is a dynamic environment requiring ongoing modification of instruction to enhance learning for each student.

6 Reading, Writing, and Oral Communication

The competent teacher has foundational knowledge of reading, writing, and oral communication within the content area and recognizes and addresses student reading, writing, and oral communication needs to facilitate the acquisition of content knowledge.

7 Assessment

The competent teacher understands and uses appropriate formative and summative assessments for determining student needs, monitoring student progress, measuring student growth, and evaluating student outcomes. The teacher makes decisions driven by data and curricular and instructional effectiveness and adjusts practices to meet the needs of each student.

8 Collaborative Relationships

The competent teacher builds and maintains collaborative relationships to foster cognitive, linguistic, physical, social and emotional development. This teacher works as a team member with professional colleagues, students, parents or guardians, and community members.

9 Professionalism, Leadership, and Advocacy

The competent teacher is an ethical and reflective practitioner who exhibits professionalism, provides leadership in the learning community, and advocates for students, parents, or guardians, and the profession.

Required Texts:

5 Practices for Orchestrating Productive Mathematics Discussions. M.S. Smith and M.K. Stein (2011) National Council of Teachers of Mathematics, Reston, VA.

Children's Mathematics: Cognitively Guided Instruction. Thomas P. Carpenter, Elizabeth Fennema, Megan Loef Franke, Linda Levi, and Susan B. Empson (1999). Portsmouth, NH: Heinemann.

Elementary and middle school mathematics: Teaching developmentally (8th edition). J. Van de Walle, K. Karp, & J. Bay-Williams (2009). Boston: Pearson Education.

Extending Children's Mathematics: Fractions and Decimals. (Innovations in Cognitively Guided Instruction). Empson, S. B. & Levi, L. (2011). Portsmouth, NH: Heinemann.

National Council of Teacher of Mathematics (2000). Principles and Standards for School Mathematics. Available for reading and/or ordering at www.nctm.org.

Thinking Mathematically: Integrating Arithmetic and Algebra in Elementary School, Thomas P. Carpenter, Megan Loef Franke, and Linda Levi. Portsmouth, NH: Heinemann.

What's Math Got to do With It? J. Boaler (2008). New York: Penguin Group

Additional articles will be provided.

		Course Schedule and Topics:	For next class:
Week 1	Wed. Sept 25	Structure of an elementary mathematics classroom (Math History – Single digit addition, problem types)	NCTM Ch 1-3 VDW Ch 2 CGI Ch 1-3
specific standards and indicators to be addressed in this class:		1B, 1C, 1E, 1F, 1K, 2A, 2D, 2E, 2M, 2N, 3K, 3L, 3M, 4A, 4I, 4L, 4M, 5F, 5G, 5H, 5J, 5K, 5L, 5M, 9A, 9H	
Week 2	Wed. Oct 2	A vision for school mathematics – Standards (Base ten, Equity Pedagogy)	VDW pp. 148-158, 216-228, Ch 3
specific standards and indicators to be addressed in this class:		1A, 1B, 1C, 1E, 2B, 2C, 2F, 2I, 2O, 3A, 3B, 3E, 3H, 5L, 6A, 7B, 7D, 7E, 7G, 7J, 7O, 9A, 9D	
Week 3	Wed. Oct 9	Tools and Frameworks (problem types, categorize, x and / situations)	VDW pp.158-168, CGI Ch. 4
specific standards and indicators to be addressed in this class:		1A, 1B, 1C, 1D, 1E, 1G, 1H, 1J, 1K, 2A, 2B, 2C, 2F, 2G, 2I, 2J, 2K, 2L, 2M, 2O, 3A, 3B, 3D, 3I, 3J, 3K, 3M, 3N, 3O, 3P, 3Q, 4C, 4D, 4E, 4M, 5A, 5C, 5G, 5H, 5J, 5L, 5M, 5P, 6C, 6D, 6E, 6G, 6H, 6I, 6J, 6K, 6L, 6M, 6Q, 6R, 6S, 7E, 7G, 7I, 7J, 7K, 7M, 7Q, 7R	
Week 4	Wed. Oct 16	Opening routines Multi digit x and /	VDW pp. 237-246, 249-254, CGI pp. 5-7
specific standards and indicators to be addressed in this class:		1A, 1B, 1C, 1D, 1E, 1H, 1I, 1J, 1K, 1L, 2A, 2B, 2C, 2D, 2E, 2G, 2H, 2I, 2J, 2K, 2M, 2N, 2P, 2Q, 3A, 3C, 3D, 3F, 3G, 3H, 3I, 3J, 3K, 3L, 3M, 3O, 3P, 3Q, 4D, 4E, 4I, 4J, 4K, 4L, 4M, 4N, 4P, 5A, 5C, 5D, 5E, 5F, 5G, 5H, 5J, 5K, 5M, 5P, 6B, 6C, 6D, 6E, 6F, 6G, 6H, 6I, 6K, 6L, 6N, 6P, 6Q, 6R, 6S, 7B, 7E, 7F, 7G, 7I, 7J, 7L, 7M, 7Q, 7R, 8H, 8I, 8T	
Week 5	Wed. Oct 23	Posing problems decimals	VDW Ch 18, 19, 21 Boaler
specific standards and indicators to be addressed in this class:		1A, 1B, 1C, 1D, 1E, 1G, 1H, 1I, 1J, 1K, 1L, 2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2K, 2M, 2N, 2P, 2Q, 3A, 3B, 3C, 3D, 3E, 3F, 3G, 3H, 3I, 3J, 3K, 3L, 3M, 3N, 3O, 3P, 3Q, 4B, 4C, 4D, 4E, 4I, 4M, 4N, 5A, 5C, 5D, 5E, 5G, 5H, 5J, 5L, 5M, 5P, 5Q, 6B, 6C, 6E, 6F, 6G, 6I, 6J, 6K, 6O, 6P, 6Q, 6R, 7B, 7E, 7F, 7G, 7I, 7J, 7L, 7M, 7Q, 7R, 8H, 8I, 8T	
Week 6	Wed. Oct 30	Reflective Practice	5 practices
specific standards and indicators to be addressed in this class:		1B, 1C, 1D, 1E, 1F, 1H, 1J, 1K, 1L, 2A, 2C, 2G, 2I, 2K, 2M, 2N, 2O, 3A, 3B, 3C, 3D, 3G, 3H, 3I, 3J, 3K, 3M, 3Q, 4D, 4E, 4I, 4K, 4L, 4M, 5A, 5B, 5C, 5D, 5E, 5F, 5G, 5H, 5I, 5J, 5K, 5L, 5M, 5P, 5R, 5S, 6G, 6K, 6N, 7L, 7M, 8A, 8K, 8L, 8N, 8O, 8P, 8Q, 9A, 9D, 9E, 9G, 9H, 9I, 9K, 9L, 9N, 9O, 9P, 9Q	
Week 7	Wed. Nov 6	Making sense of student work Fractions (rods, number line, percents)	VDW Ch 15, 16, 17 Empson Bring an interesting box to class next week
specific standards and indicators to be addressed in this class:		1A, 1B, 1C, 1D, 1E, 1G, 1K, 2A, 2B, 2C, 2E, 2G, 2K, 2M, 3C, 3D, 3E, 3G, 3J, 3K, 3M, 3N, 3O, 4H, 4L, 5A, 5G, 5H, 5I, 5J, 5P, 6B, 6D, 6E, 6F, 6H, 6K, 6P, 6Q, 7B, 7E, 7G, 7I, 7M, 7Q, 7R, 8H, 8I	
Week 8	Wed.	Facilitating discussion of strategies	VDW Ch 20, 5

	Nov 13	Geometry area sequence, Geometry 3d to 2d	
specific standards and indicators to be addressed in this class:		1A, 1B, 1C, 1D, 1E, 1G, 1H, 1I, 1J, 1K, 1L, 2A, 2B, 2C, 2D, 2E, 2G, 2H, 2J, 2K, 2M, 2N, 2O, 2Q, 3C, 3D, 3E, 3G, 3H, 3J, 3K, 3M, 3O, 4A, 4B, 4C, 4D, 4E, 4I, 4J, 4K, 4L, 4M, 4N, 4O, 4P, 5A, 5F, 5G, 5H, 5I, 5J, 5K, 5M, 5P, 5Q, 5R, 5S, 6A, 6C, 6E, 6F, 6K, 6Q, 6R, 6S, 7B, 7K, 7Q, 7R, 8H, 8I	
Week 9	Wed. Nov 20	Math Talk Framework Algebra, graphing, order of operations	VDW Ch 14 Thinking mathematically
specific standards and indicators to be addressed in this class:		1A, 1B, 1D, 1E, 1J, 1K, 2D, 2E, 2G, 2H, 2J, 2K, 2M, 2O, 3B, 3C, 3F, 3H, 3I, 3J, 3K, 3L, 3M, 3O, 3P, 4B, 4C, 4D, 4E, 4G, 4I, 4J, 4K, 4L, 4M, 4N, 4P, 5F, 5K, 5L, 5M, 5R, 6C, 6D, 6E, 6F, 6K, 6L, 6O, 6P, 6Q, 6R, 6S, 7K, 7L	
	Wed. Nov 27	No class Thanksgiving Holiday	MTLC articles
Week 10	Wed. Dec 4	Pulling it all together – student led lessons	
specific standards and indicators to be addressed in this class:		1B, 1D, 1F, 1J, 1I, 1K, 1L, 2A, 2C, 2D, 2E, 2F, 2G, 2I, 2K, 2L, 2M, 2N, 2O, 2P, 2Q, 3A, 3B, 3C, 3H, 3I, 3J, 3K, 3M, 3N, 3O, 3Q, 4C, 4D, 4E, 4I, 5A, 5, 5E, 5F, 5G, 5H, 5I, 5J, 5K, 5L, 5M, 5R, 5S, 6C, 6E, 6F, 6G, 6I, 6J, 6Q, 6S, 7A, 7B, 7E, 7F, 7G, 7I, 7J, 7K, 7L, 7M, 7Q, 7R, 9K	

Response Papers:

There will be readings assigned for each week. Please comment on the reading for the week in a brief response paper of no more than one page. The purpose of this exercise is not to summarize the reading, but to draw connections between ideas we are discussing in the course and to raise questions brought up by the readings that might be useful for the whole class to process together. Along those lines, please submit this by 6 pm on the Tuesday before class on Wednesday to my email address: kimhufferd-ackles@openwingslearning.org.

Student interview:

This project will focus on learning what understanding a student has about a mathematical topic through the utilization of a task and interview protocol that you will develop. It would be helpful to connect with an elementary student who is different from you socio-culturally and is currently struggling to develop mathematical understanding. You will write a comprehensive reflective paper about this experience of 4-5 pages. In it you will discuss your findings about the student's current understandings in the broad topic area of your focus and next steps you recommend to build understanding. You will include your interview protocol and description of the tasks (including manipulatives) used as attachments. Please have a student selected and bring a draft of your interview protocol to class on October 9. This will be due in class **October 23**.

Preparing, teaching, and reflections on a lesson:

You will design a lesson plan that is aimed at eliciting and extending student thinking about a challenging math topic. For this task, we will utilize one of the newer elementary-level and standards-based curricula, *Math Expressions* (Houghton Mifflin, 2009). This connects closely with the CCSS. This curriculum is the source of rich tasks for students and provides important information for teachers about children's mathematical thinking on the topics explored.

All students will present a portion of this lesson in the final class session. Prior to this, you will submit a draft plan of the lesson plan for review and comment.

Grades:

It is expected that you will complete all course assignments, and attend all class sessions. You are also expected to participate in class discussions and activities each week. Assignments will be rated along the following dimensions: Highly Proficient (3 points), Proficient (2 points), In Progress (1 point), Minimum Standards Not Met (0 points). Final grade will be determined based on the following:

Assignments (weekly response papers, student interview)	33%
Lesson plan and implementation	33%
Class Participation (including in-class reflections)	33%

Academic Integrity:

Students in this course are expected to comply with the policies found in the booklet, "Academic Integrity at Northwestern University: A Basic Guide." All papers submitted for credit in this course must be sent as email attachments as well as delivered in printed form. Your written work may be electronically tested for plagiarized content. For details regarding academic integrity at Northwestern, visit: <http://www.northwestern.edu/uacc/>. If you need a copy of the brochure visit the SESP Student Affairs Office.

Accommodations for Students with Disabilities:

In compliance with Section 504 of the 1973 Rehabilitation Act and the Americans with Disabilities Act, Northwestern University is committed to providing equal access to all programming. Students with disabilities seeking accommodations are encouraged to contact the office of Services for Students with Disabilities (SSD) at 467-5530 or ssd@northwestern.edu. SSD is located in the basement of Scott Hall. SSD also has an excellent web-site which is viewable at: <http://www.stuaff.northwestern.edu/ssd/>