

School of Education
University of Puget Sound
Fall 2008

Tuesday, Thursday 1:00-2:50 p.m.
Howarth 212

Education 616
Elementary Learning and Teaching
Mathematics and Science

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Abandon the notion of subject-matter as something fixed and readymade in itself, outside the child's experience; cease thinking of the child's experience as also something hard and fast; see it as something fluent, embryonic, vital; and we realize that the child and the curriculum are simply two limits which define a single process. John Dewey

COURSE DESCRIPTION

This course is one module in the 3-unit elementary curriculum and instruction course. We will examine issues related to math and science instruction in the K-8 curriculum, emphasizing multiple approaches to teaching mathematics and science. We will consider the tension between giving full attention to each subject area, integrating across subject areas, and meeting students' developmental needs.

The daily life in a classroom is the result of dynamic and complex interactions amongst students, teachers, and subject matter. Throughout the semester we will explore our assumptions and beliefs regarding teaching and learning and the ways in which teaching methodologies, classroom management, and curriculum issues interface. The course emphasizes how these dynamics limit and expand opportunities for student learning. Below are questions that will be explored:

- What types of learning opportunities foster student inquiry and collaboration?
- How do multiple forms of representation enhance understanding of mathematics and science?
- What approaches to instruction and assessment promote mathematics and science learning?

Learning to be a great elementary teacher is the work of a lifetime; this seminar aims to help you build a foundation from which to continually learn and grow. Throughout this course you will examine teaching as an ongoing active intellectual process.

Youth Development Framework

This course is organized to emphasize a youth development perspective. This perspective spotlights the trajectory of the learner and suggests that opportunities for skill building, relationship building, youth engagement, and community involvement are resources necessary to support the development of the learner. Each of these resources highlights different implications for teachers, students and subject matter, as well as a number of potential questions to consider:

Skill Building—What is the nature of science and math? What skills and knowledge do students have access to? What tools and concepts are important in science and math? What is the role of local, state, and national standards in defining required skills and knowledge?

Relationship Building—How are relationships amongst students and between students and teacher built and maintained? Do students view adults and classmates as resources to learning? Do students and teachers feel a sense of belonging? What does it mean to know students as learners and people?

Youth Engagement—What does active participation mean? Does learning relate to problems and questions that have meaning to students? How can student perspectives inform classroom planning and evaluation? Do students have input in decision-making?

Community Involvement—Are students engaged in a variety of contexts? How do different contexts bring value and meaning to the skills and knowledge learned in another context? How are linkages between different contexts maintained and organized?

COURSE OBJECTIVES AND PROGRAM GOALS

The two main objectives of this course are:

- You will practice teaching, consider the assumptions behind methods used, and articulate your personal pedagogy by teaching a math lesson and a science lesson, leading a reading discussion, preparing an integrated unit plan, and providing feedback on lessons presented by other students.
- You will analyze and critique elements of the youth development framework and develop multiple lenses for understanding the relationships between teacher, student and math/science subject matter, by participating in class discussions, writing reading reflections, analyzing artifacts of student learning, and developing and teaching lessons.

To prepare teachers who: (bold indicates goals emphasized in this course)

- 1) Have deep understanding of subject matter and pedagogies that teach for understanding**
- 2) Have ability to manage the complexities of teaching**
- 3) Promote student learning of challenging content**
- 4) Have ability to reflect on their own practice, to look for principles underlying what “works” or “does not work” and to persist in determining their own appropriate practice**
- 5) Have commitment to serving everyone’s children, particularly those who historically have not been well-served by traditional schooling**
- 6) Have ability to learn and work in a collaborative fashion, and to create settings in which others can learn and work**
- 7) Have capacity to engage in the remaking of the profession and the renewal of schools with understanding of the social and cultural context in which students live and learn

OUTLINE OF CONTENT AND SCHEDULE OF COURSEWORK

Tuesday	Thursday
Course Overview	
9/9 Math Explorations Course Framework	9/11 Descriptive Field Investigation Syllabus and Organization of Assignments
Skill Building	
9/16 Math Lesson (Early Number Concepts) Lesson Critique and Extensions	9/18 Matching the Math Lesson to Math Standards Reading Discussion
9/23 Science Lesson (Comparative Field Investigation) Lesson Critique and Extensions	9/25 Reflection 1 Due: Professional Journal Matching the Science Lesson to Science Standards Reading Discussion ()
9/30 Assessment/Rubric Development Think Quick-Tools	Wed. 10/1 Learning and Gender Reading Discussion
Relationship Building	
10/7 Whole-Number Place-Value Lesson Refining the Rubric	10/9 Reading Discussion () Lesson Planning Workshop
10/14 Reflection 2 Due: Student Case Multiplication Lesson Reading Discussion ()	10/16 Field Investigation—Wright Park Reading Discussion
10/21 Holiday-Fall Break	10/23 Learning and Poverty Reading Discussion
Youth Engagement	
10/28 Measurement Lesson Theme Summary	10/29 Chris at WACTE Fraction Concepts Lesson Geometry Lesson
11/4 Reading Discussion () Lesson Planning Workshop	10/30 Reflection 3 Due: Visual Data Analysis Lesson Reading Discussion ()
11/11 Reading Discussion () Lesson Planning Workshop	11/6 Integrated Unit Planning Workshop
Community Involvement	
11/18 Reflection 4 Due: Compelling Issue FOSS Lesson Theme Summary	11/19 Learning and Race Reading Discussion
11/24 Margaret Tudor WA Dept. Fish and Wildlife	11/20 Ryken at NSTA Class with Chris
11/25 Integrated Unit Planning Workshop	11/27 Holiday—Thanksgiving No Class
12/2 FOSS Lesson FOSS Lesson	12/4 FOSS Lesson Reading Discussion ()
12/9 Course Evaluation Reading Discussion ()	12/10 Integrated Unit Planning Workshop
MONDAY 12/15	
Integrated Unit Exhibition, 10:00 a.m.-12:00 noon	

STUDENT REQUIREMENTS AND EVALUATION

Assignment expectations and deadlines for rotating assignments will be discussed in class. Assignments must be submitted at the beginning of class on the date they are due. You will make an appointment with the professor in the event that you must submit late work. Late work will not be credited at full value.

Math Lesson—You and your team members will teach a math lesson on an assigned topic. One week after presenting the lesson you will turn in a 5-7 page double-spaced typed summary including a lesson plan and your reflections after the lesson. A detailed handout of requirements will be distributed in class. (20% of final grade)

Science Lesson—You and your team members will teach a science lesson from a Full Option Science System (FOSS) unit of instruction. One week after presenting the lesson you will turn in a 5-7 page double-spaced typed summary including a your reflections after the lesson and potential adaptations for a range of learners. A detailed handout of requirements will be distributed in class. (20% of final grade)

Reading Discussion—You and a partner will lead a discussion of assigned readings. You will prepare a 1-2 page handout that summarizes the main points presented in the reading (to be distributed to your classmates). You will bring a curriculum or student work artifact from your school-based placement for analysis during the discussion. A detailed handout of requirements will be distributed in class. (10 % of final grade)

Reading Reflection—In preparation for class discussions you will write brief notes/questions on assigned readings each week. You will then write four reflections: 1) a survey of professional journals, 2) a case study of one elementary student, 3) a visual, and 4) an analysis of a compelling issue. The purpose of the reflections is to help you summarize the main ideas in the readings, integrate school-based experiences with classroom readings, and provide an opportunity to build a written portfolio that may help you formulate the literature review for your master's project. A detailed handout of requirements will be distributed in class. (24% of final grade)

Class Attendance, Punctuality and Participation—You will take multiple roles in the class, by teaching lessons, evaluating the teaching of others, completing in-class writing assignments, sharing insights from school-based placement experiences, and participating as a productive and positive community member. Interpersonal skills (e.g., actively working to build relationship with others, considering other points of view, and considering the time and needs of others), problem solving (e.g., considering multiple perspectives, responding positively to feedback, and asking questions), and work ethic (e.g., consistent attendance, completing work by deadlines, and flexibility) are critical to your development as a professional. You will self assess your participation and the professor will assess your participation. (16% of final grade)

Integrated Inquiry Unit and Exhibit—You will develop the framework of a thematic unit, by identifying natural points of integration across different subject areas, as well as the resources needed to engage your students in the processes of question formation, research, and presentation/celebration. You will share your findings with classmates by presenting a poster exhibit. A detailed handout of requirements will be distributed in class. (10% of final grade)

Required Texts

1. Van De Walle, J. (2007). *Elementary and middle school mathematics: Teaching developmentally*, 6th Edition. Boston, MA: Allyn & Bacon.
2. A course reader contains other required articles and book chapters. The articles in the reader have been selected to provide alternative viewpoints related to the work of teachers, the role of students and the nature of science and math content. In addition, these readings set the issues of teaching math and science in a larger youth development framework.
3. Office of Superintendent of Public Instruction (OSPI). (2005). *Science K-10 grade level expectations*, Document Number 04-0051. Olympia, WA: OSPI. (this will be distributed in class)
4. Office of Superintendent of Public Instruction (OSPI). (2008). *Adopted Washington state K-8 mathematics standards*. Available at <http://www.k12.wa.us/curriculumInstruct/mathematics/RevisedStandards/k-8-washington-08april28.pdf> (this will be distributed in class)

Recommended Text

Kelsey, K. & Steel, A. (2001). *The truth about science: A curriculum for developing young scientists*. Arlington, VA: National Science Teachers Association.

Schedule of Weekly Readings

9/18—The Nature of Science and Math

Smith, S. S. (2009). Early math concepts: Matching, classification, comparing, and ordering or seriation. In *Early childhood mathematics, 4th edition*. (pp. 71-87). Boston: Pearson.

Foster, G.W. (1999). Ch. 4, Why is the sky blue? In *Elementary mathematics and science methods: Inquiry teaching and learning*. (pp. 61-81). Belmont, CA: Wadsworth Publishing Company.

Barnes, M.K. (2006). How many days 'til my birthday?: Helping kindergarten students understand calendar connections and concepts. *Teaching Children Mathematics, 12(6)*, 290-295.

9/25—Linking Assessment and Instruction

Van De Walle, J. Ch. 6, Blurring the line between instruction and assessment. (pp. 78-94).

Fulwiler, B.R. (2007). Ch. 4, Teaching simple forms of scientific thinking and expository writing. In *Writing in science: How to scaffold instruction to support learning*. (pp. 44-80). Portsmouth, NH: Heinemann.

Chapin, S. H., O'Conner, C., & Anderson, N. C. (2003). Solution methods and problem solving strategies. In *Classroom discussions: Using math talk to help students learn*. (pp. 73-77). Sausalito, CA: Math Solutions Publications.

10/1—Learning and Gender

King, K., & Gurian, M. (2006). Teaching to the minds of boys. *Educational Leadership, 64* (1), 56-61.

Becker, J. R. (2003). Gender and mathematics: An issue for the twenty-first century. *Teaching Children Mathematics, 9* (8), 470-473.

10/9—Knowing Students as People and as Learners

Gibbs, J. (2000). Ch. 4, What tribes are and how they work & Ch. 5, Creating the learning community. In *Tribes: A new way of learning and being together*. (pp. 71-86, 87-103). Sausalito, California: Center Source Systems.

Ball, D.L. (1997). From the general to the particular: Knowing our own students as learners of mathematics. *The Mathematics Teacher*, 90, 732-737.

10/14—Relational Understanding

Van De Walle, J. Ch. 3, Developing understanding in mathematics. (pp. 22-36).

Smith, S. S. (2009). Assessment. In *Early childhood mathematics, 4th edition*. (pp. 38-53). Boston: Pearson.

10/16—Field Investigation: Wright Park

Jacobs, J. (1993). The uses of neighborhood parks. In *The Death and Life of Great American Cities*. New York: The Modern Library.

McDaniels, L. (2008, Summer). Hothouse; hot topic. *Arches*, 35 (4), 5-7.

10/23—Learning and Poverty

Rothstein, R. (2008). Whose problem is poverty? *Educational Leadership*, 65 (7), 8-13.

Payne, R. (2008). Nine powerful strategies. *Educational Leadership*, 65 (7), 48-52.

10/30—Engaging All Students

Chapin, S. H., O'Conner, C., & Anderson, N. C. (2003). Getting started. In *Classroom discussions: Using math talk to help students learn*. (pp. 109-130). Sausalito, CA: Math Solutions Publications.

Van De Walle, J. Ch. 7, Teaching mathematics equitably to all children. (pp. 95-106).

Teaching math to English language learners. (2005). Northwest Education, 14-15.

11/4—Balancing Subject Matter Requirements and the Child's Needs

Lowery, L.F. (1998). *The biological basis of thinking and learning*. Berkeley, CA: Regents of the University of California.

Corwin, R.B., Storeygard, J. & Price, S.L. (1996). Section two: Supporting classroom talk. In *Talking mathematics: Supporting children's voices*. (pp. 17-39). Portsmouth, NH: Heinemann.

11/11—Integrated Curriculum

Civil, M. & Khan, L. (2001). Mathematics instruction developed from a garden theme. *Teaching Children Mathematics*, 7 (7), 400-405.

Sorel, K. (2005). The integrated curriculum, *Science and Children*, 42(6), 21-25.

Coskie, T., Hornof, M., & Trudel, H. (2007). A natural integration. *Science and Children*, 44(8), 26-31.

11/13—Big Ideas and Unit Planning

Tomlinson, C.A., & McTighe, J. (2006). What really matters in learning? (Content). In *Integrating differentiated instruction & understanding by design*. (pp. 24-37, 110-115). Alexandria, VA: Association for Supervision and Curriculum Development.

11/19—Learning and Race

Watkins, G. (bell hooks). (1994). Introduction, Teaching to transgress. In *Teaching to transgress: Education as the practice of freedom*. (pp. 1-12). New York: Routledge.

Villegas, A. M., & Lucas, T. (2007). The culturally responsive teacher. *Educational Leadership*, 64 (6), 28-33.

12/4—Project Based Learning

Woods, H.R. (Fall 2003). Early birding. *California Wild*, 43-45.

Diffily, D. (2001). Project reptile! *Science and Children*, 38 (7), 30-35.

Wolfinger, D.M. (2005). Project produce. *Science and Children*, 42(4), 26-29.

12/9—Connecting to Community Members and Organizations

Bodzin, A. & Gehringer, M. (2001). Breaking science stereotypes: Can meeting actual scientists change students' perceptions of scientists? *Science and Children*, 38 (4), 36-41.

Brune, J. (2002). Take it outside! *Science and Children*, 39(7), 29-33.

Stivers, L. (2002). Discovering trees: Not just a walk in the park! *Science and Children*, 39(7), 38-41.

WASHINGTON ADMINISTRATIVE CODE (W.A.C.) TOPICS

The Washington Administrative Code (W.A.C.) identifies three knowledge and skill areas for teacher certification (1. foundational knowledge, 2. effective teaching, 3. professional development) and lists specific topics of study. Many items we explore in this course are given complementary coverage in additional MAT courses. We often treat important topics in a spiral fashion, raising them more than once during your coursework to place them in a broader, more meaningful context. The following W.A.C. topics are incorporated in this course:

Teacher candidates will complete a well-planned sequence of courses and/or experiences in which they acquire and apply knowledge about:

Foundational Knowledge

- (a) The state learning goals and essential academic learning requirements.
- (b) The subject matter content for the area(s) they teach, including relevant methods course work and the knowledge and skills for each endorsement area for which the candidate is applying.

Effective Teaching

- (l) Research and experience-based principles of effective practice for encouraging the intellectual, social, and personal development of students.
- (m) Different student approaches to learning for creating instructional opportunities adapted to learners of both sexes and from diverse cultural or linguistic backgrounds.
- (o) Effective instructional strategies for students at all levels of academic abilities and talents with an awareness of the influence of culture and gender on student learning.
- (p) Instructional strategies for developing reading, writing, critical thinking, and problem solving skills.
- (r) Classroom management and discipline, including:
 - (i) Individual and group motivation for encouraging positive social interaction, active engagement in learning, and self-motivation.
 - (ii) Effective verbal, nonverbal, and media communication for fostering active inquiry, collaboration, and supportive interactions in the classroom.
- (s) Planning and management of instruction based on knowledge of the content area, the community, and curriculum goals.
- (t) Formal and informal assessment strategies for evaluating and ensuring the continuous intellectual, social, and physical development of the learner.

Professional Development

- (w) The opportunity for candidates to reflect on their teaching and its effects on student growth and learning.

BIBLIOGRAPHY

Consult the web sites and professional organizations listed below for additional background information and/or to continue to explore the issues discussed in this course.

Internet Resources

Organization	Web Site
General Resources	
Washington State Essential Academic Learning Requirements (EALR's)	www.k12.wa.us/CurriculumInstruct/default.aspx
Washington Assessment of Student Learning (WASL)	http://www.k12.wa.us/assessment/WASL/testquestions.aspx
Inside Teaching: A Living Archive of Practice The Carnegie Foundation for the Advancement of Teaching	http://gallery.carnegiefoundation.org/insideteaching/
Math Resources	
National Council of Teachers of Mathematics	www.nctm.org
Washington State Mathematics Council	www.wsmc.net
Math Forum	www.mathforum.org
Science Resources	
National Science Teachers Association	www.nsta.org
Washington Science Teachers Association	www.wsta.net
Lawrence Hall of Science Great Explorations in Math and Science (GEMS)	www.lawrencehallofscience.org/GEMS
Science Notebooks	www.sciencenotebooks.org
Environmental Education Resources	
Center for Environmental Education	http://www.cceonline.org/
Environmental Protection Agency	http://www.epa.gov/teachers/
Project WILD	http://www.projectwild.org/
Washington Department of Fish and Wildlife	www.wa.gov/wdfw
Sierra Club	http://www.sierra-club.org/education/

Professional Organizations

Professional organizations are one way to get involved with a network of math and science educators and to have access to ongoing professional development opportunities. Two organizations you might consider joining are listed below:

National Council of Teachers of Mathematics (NCTM), \$38/year (for students) entitles you to an online subscription to *Teaching Children Mathematics*. Apply online at www.nctm.org or call (800) 235-7566.

National Science Teachers Association (NSTA), \$32/year (for students) entitles you to a monthly subscription to *Science and Children*. Apply online at www.nsta.org or call (800) 722-6782.

Upcoming Conferences

Conferences are ideal for obtaining curriculum materials and for getting involved with other educators. Two conferences you might consider attending are listed below:

- **Washington State Mathematics Council**
47th Northwest Mathematics Conference
October 9-11, 2008
Portland, OR
\$40 for pre-service teachers to register
See program and register at www.wsmc.net/nwmc
- **Washington Science Teachers Association Spring Conference**
Shifting Science Instruction
March 19-21, 2009
Moses Lake, WA
\$55 for pre-service teachers to register
See program and register at www.wsta.net
- **National Science Teachers Association Area Conference**
Sustainable Science
November 20-22, 2008
Portland, OR
\$60 for pre-service teachers to register
See program and register at <http://www.nsta.org/conferences/2008por/>