

School of Education
University of Puget Sound
Fall 2009

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

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

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 your colleagues.
- 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.

MAT PROGRAM GOALS

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

| Monday | Wednesday | |
|--|---|---|
| Skill Building | | |
| 9/7 Holiday-Labor Day | 9/9 Math Explorations Syllabus and Organization of Assignments | |
| 9/14 Descriptive Field Investigation | 9/16 Math Lesson & Standards (Early Number Concepts) Reading Discussion | |
| 9/21 Science Lesson (Comparative Field Investigation) | 9/23 Reflection 1 Due: Professional Journal Connecting the Science Lesson to Science Standards Reading Discussion () | |
| 9/28 Assessment/Rubric Development Theme Summary | 9/30 No Outsiders: Learning and Gender | |
| Relationship Building | | |
| 10/5 Whole-Number Place-Value Lesson Refining the Rubric | 10/7 Reading Discussion () Lesson Planning Workshop | |
| 10/12 Reflection 2 Due: Student Case Lesson Planning Workshop | 10/14 Multiplication Lesson Reading Discussion () | Thurs. 10/15 Field Investigation— Wright Park |
| 10/19 Holiday-Fall Break | 10/21 Measurement Lesson Geometry Lesson | Thurs. 10/22 No Outsiders: Learning and Poverty |
| Youth Engagement | | |
| 10/26 Fraction Concepts Lesson Theme Summary | 10/28 Reflection 3 Due: Visual Data Analysis Lesson Reading Discussion () | |
| 11/2 No Outsiders: Learning and Sexuality | 11/4 Reading Discussion () Lesson Planning Workshop | Thurs. 11/5 Integrated Unit Planning Workshop |
| 11/9 Lesson Planning Workshop | 11/11 FOSS Lesson Reading Discussion () | Thurs. 11/12 Integrated Unit Planning Workshop |
| Community Involvement | | |
| 11/16 Reflection 4 Due: Compelling Issue FOSS Lesson Theme Summary | 11/18 No Outsiders: Learning and Race | |
| 11/23 Margaret Tudor WA Dept. Fish and Wildlife | 11/24 Integrated Unit Planning Workshop | 11/25 Holiday—Thanksgiving No Class |
| 11/30 FOSS Lesson FOSS Lesson | 12/2 FOSS Lesson Reading Discussion | |
| 12/7 Course Summary Reading Discussion | Wed. 12/9 Integrated Unit Planning Workshop | |
| MONDAY 12/14 | | |
| 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 colleagues). 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, analyzing 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 colleagues 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. A., Karp, K. S., & Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally*, 7th Edition. Boston, MA: Pearson Education, Inc. This text is a professional resource that you will use throughout your career. In addition to the assigned chapters below, you will read a chapter specific to the content of your assigned math lesson.
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. *Washington State K-12 Science Learning Standards*. (will be distributed in class)
<http://www.k12.wa.us/CurriculumInstruct/Science/pubdocs/WAScienceStandardsFINAL.pdf>
4. *Washington K-8 Mathematics Standards*. (will be distributed in class)
<http://www.k12.wa.us/CurriculumInstruct/mathematics/RevisedStandards/WAMathStandardsGradesK-8.pdf>

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

9/16—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.

9/23—Linking Assessment and Instruction

Van De Walle, J. A., Karp, K. S., & Bay-Williams, J. M. Ch. 5, Building assessment into instruction. (pp. 76-92).

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.

9/30—No Outsiders: Learning and Gender

Rosenberg, R. (2007, May 21). (Rethinking) gender. *Newsweek*. Retrieved May 20, 2009 from <http://www.newsweek.com/id/34772>.

Riseman, M. (2006, August 13). My pink boy. *San Francisco Chronicle*. Retrieved May 20, 2009 from <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2006/08/13/CMGDOIM9ME1.DTL>.

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

10/7—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.

10/14—Relational Understanding

Van De Walle, J. A., Karp, K. S., & Bay-Williams, J. M. Ch. 3, Teaching through problem solving. (pp. 32-57).

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

10/15—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.

10/22—No Outsiders: 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.

Bomer, R., Dworin, J. E., May, L., & Semingson, P. (2008). Miseducating teachers about the poor: A critical analysis of Ruby Payne's claims about poverty. *Teachers College Record*, 110 (12), 2497-2531.

10/28—Engaging All Students

Chapin, S. H., O’Conner, C., & Anderson, N. C. (2003). Ch. 2, The tools of classroom talk. In *Classroom discussions: Using math talk to help students learn*. (pp. 11-42). Sausalito, CA: Math Solutions Publications.

Van De Walle, J. A., Karp, K. S., & Bay-Williams, J. M. Ch. 6, Teaching mathematics equitably to all children. (pp. 93-110).

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

11/2—Learning and Sexuality

DePalma, R. (not dated). *Frequently asked questions*. Retrieved May 20, 2009 from <http://www.nooutsiders.sunderland.ac.uk/teachres/dcsf-guidance-safe-to-learn-downloads-and-faqs/Frequently%20asked%20questions%20001.doc/view>.

Epstein, D. (2000). Reading gender, reading sexualities: Children and the negotiation of meaning in “alternative texts.” In Spurlin, William J (Ed.) *Lesbian and Gay Studies and the Teaching of English*. (pp. 213-233). Washington, D.C.: National Council for Teaching of English.

Crocco, M. S. (2002). Homophobic hallways: Is anyone listening? *Theory and Research in Social Education*, 30 (2), 217-232.

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

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

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.

Hadaway, N. L. (2009). A narrow bridge to academic reading. *Educational Leadership*, 66 (7), 38-41.

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.

11/12—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.

11/18—No Outsiders: Learning and Race

Chang, K., & Conrad, R. (2008). Ch. 7, Following children's leads in conversations about race. In *Everyday antiracism: Getting real about race in school*. (pp. 34-38). New York: The New Press.

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

12/2—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.

12/7—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.

Schwarz, J., Havens, K., & Vitt, P. (2008). Understanding climate change through citizen science. *Roots*, (5) 1, 18-21.

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. 181-78A-220(5) identifies four knowledge and skill areas for teacher certification (listed below). These standards for professional practice are an important lens for reflecting on your growth and development as an educator.

Knowledge of Subject Matter and Curriculum Goals

(a) Teacher candidates positively impact student learning that is:

- (i) **Content driven.** All students develop understanding and problem-solving expertise in the content area(s) using reading, written and oral communication, and technology.
- (ii) **Aligned with curriculum standards and outcomes.** All students know the learning targets and their progress toward meeting them.
- (iii) **Integrated across content areas.** All students learn subject matter content that integrates mathematical, scientific, and aesthetic reasoning.

Knowledge of Teaching

(b) Teacher candidates positively impact student learning that is:

- (i) **Informed by standards-based assessment.** All students benefit from learning that is systematically analyzed using multiple formative, summative, and self-assessment strategies.
- (ii) **Intentionally planned.** All students benefit from standards-based planning that is personalized.
- (iii) **Influenced by multiple instructional strategies.** All students benefit from personalized instruction that addresses their ability levels and cultural and linguistic backgrounds.
- (iv) **Informed by technology.** All students benefit from instruction that utilizes effective technologies and is designed to create technologically proficient learners.

Knowledge of Learners and their Development in Social Contexts

(c) Evidence of teacher candidate practice reflects planning, instruction and communication that is:

- (i) **Learner centered.** All students engage in a variety of culturally responsive, developmentally, and age appropriate strategies.
- (ii) **Classroom/school centered.** Student learning is connected to communities within the classroom and the school, including knowledge and skills for working with others.
- (iii) **Family/neighborhood centered.** Student learning is informed by collaboration with families and neighborhoods.
- (iv) **Contextual community centered.** All students are prepared to be responsible citizens for an environmentally sustainable, globally interconnected, and diverse society.

Understanding Teaching as a Profession

(d) Teacher candidates positively impact student learning that is:

- (i) **Informed by professional responsibilities and policies.** All students benefit from a collegial and professional school setting.
- (ii) **Enhanced by a reflective, collaborative, professional growth-centered practice.** All students benefit from the professional growth of their teachers.
- (iii) **Informed by legal and ethical responsibilities.** All students benefit from a safe and respectful learning environment.

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 |
|---|--|
| 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 |
| Washington State Standards Resources | |
| Washington State Essential Academic Learning Requirements (EALR's) | www.k12.wa.us/CurriculumInstruct/default.aspx |
| Washington Assessment of Student Learning (WASL) | www.k12.wa.us/assessment/WASL/testquestions.aspx |
| Environmental Education Resources | |
| Center for Environmental Education | www.cceonline.org/ |
| Environmental Protection Agency | www.epa.gov/teachers/ |
| Facing the Future | www.facingthefuture.org/ |
| Project WILD | www.projectwild.org/ |
| Washington Department of Fish and Wildlife | wdfw.wa.gov/ |
| Sierra Club | www.sierra-club.org/education/ |
| Inclusive Schools Resources | |
| No Outsiders Project | www.nooutsiders.sunderland.ac.uk/about-the-project |
| Teaching Tolerance Southern Poverty Law Center | www.tolerance.org/ |
| Welcoming Schools Human Rights Campaign | www.hrc.org/welcomingschools/ |

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), \$39/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
48th Northwest Mathematics Conference
October 22-24, 2009**
Whistler, British Columbia
\$60 for pre-service teachers to register
See program and register at www.wsmc.net/nwmc
- **Washington Science Teachers Association Spring Conference
Evolving: Science Education in a Changing World
March 12-14, 2010**
Everett, WA
\$55 for pre-service teachers to register
See program and register at www.wsta.net