

School of Education
University of Puget Sound
Fall 2009

Monday-Thursday, 11:00 a.m.-12:50 p.m.
Howarth 214

Education 618B
Learning and Teaching in the Subject Area
Mathematics and Science

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“ . . . when the textbook is used as the sole source of education, students are often turned off by its stale, static, impersonal and, often unreachable presentation.” Tarry Lindquist

“Math is hard. What is it used for? If I don’t see the purpose, I won’t get it. I say what are we going to use it for? They should apply and implement it to some actual need.” Lincoln High School Senior

“Chemistry—learning all the different elements and how they react with each other. We do a lot in the book, but no experiments—experiments would help. Lincoln High School Senior

COURSE DESCRIPTION

This 2-unit course aims to develop professional knowledge and a reflective stance toward teaching in secondary content area classrooms. It focuses on understanding various ways in which adolescents might engage with content area learning, and it engages teaching candidates in questions, stances, practices, and tensions involved in teaching particular subjects. Students in the course will generate instructional units and assessments, enact teaching both on campus and in school-based settings, examine teaching artifacts from local classrooms, and investigate the work of exemplary teachers. The course aims to involve students in a continual juxtaposition of planning, teaching, and reflective thinking. Rather than simply learning to implement given best practices, students in this course will become problem posers, challenging and considering the pros and cons of assumed practices.

By the end of the course, you will understand and be able to navigate three tensions.

Tension 1: Teachers are implementers of curriculum and pedagogical problem-posers. Teachers face the dilemma of honoring children’s logic/thinking and teaching conventional knowledge.

Tension 2: Teachers are disciplinary experts (e.g. mathematicians, scientists, writers) and human beings in a constant journey of learning. Teaching and learning occur within disciplinary communities in schools, across disciplines, and throughout the world in which we live.

Tension 3: Teachers are accountable to both public expectations and students’ diverse experiences and perspectives. Teachers navigate the space between schools as they are and schools as they might be.

COURSE OBJECTIVES

You will become agile pedagogical thinkers who:

- Through reviewing artifacts and writing reflections will learn to analyze teaching and student thinking.
- By writing lesson and unit plans will learn to create classroom environments that engage, challenge, and support students.
- By engaging in the process of planning and teaching will learn to productively utilize the process of questioning, planning, doing, assessing, and reflecting.

M.A.T. 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 one's own practice, to look for principles underlying what "works" or "does not work" and to persist in determining one's 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 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

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.

OUTLINE OF CONTENT AND SCHEDULE OF COURSEWORK

| MIDDLE SCHOOL: STUDENT LEARNING AND UNIT PLANNING | |
|--|--|
| 9/7 Holiday-Labor Day 9/8-9/10 | What are the academic and management routines in your middle school classroom? |
| 9/14-9/17 | What is the range of learning tasks in your middle school classroom? |
| 9/21-9/24 | How do learning tasks relate to state standards? |
| 9/28-10/1 | How do I assess student learning? |
| 10/5-10/8 | What is worthy of understanding? |
| 10/12-10/15 | How do I incorporate a range of assessments into my instruction? |
| 10/19-10/20 Holiday-Fall Break 10/21-10/22 | How do I incorporate a range of assessments into my instruction? |
| HIGH SCHOOL: STUDENT LEARNING AND UNIT PLANNING | |
| 10/26-10/29 | What does student learning look like up close? |
| 11/2-11/5 | What does student learning look like up close? |
| 11/9-11/12 | What is worthy of understanding? |
| 11/16-11/19 | How do I incorporate a range of assessments into my instruction? |
| 11/23-11/24 11/25-11/26 Holiday-Thanksgiving | Microteaching: What does my teaching look like? |
| 11/30-12/3 | Microteaching: What does my teaching look like? |
| 12/7-12/9 | What is cultural competence in math and science? |

STUDENT REQUIREMENTS AND EVALUATION

Assignment expectations and deadlines will be distributed and 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. These assessments are designed to make public the practices of planning, instructing, assessing, reflecting, and applying.

Classroom Artifacts—You and your school-based partner will share curriculum or student work artifacts from your placement classroom to foster discussion about teaching and learning. (10% of seminar grade)

Reflective Writing—Throughout the course of the semester you will write reflective commentaries to help you make sense of and draw connections between course experiences, assigned readings, and/or your school-based placements, and teaching experience. Reflective writing both records and gives meaning to classroom routines, curriculum, and student and teacher experiences. (10% of seminar grade)

Middle School Student Learning Analysis—You and your school-based experience partner will conduct a case study by taking a close-up look at how students interact with representations in your discipline. You will interview students to learn more about their meaning-making in your discipline, as well as their motivations and dispositions toward the subject area. (10% of seminar grade)

Middle School Unit Framework and Assessments—You and your subject matter colleagues will develop a unit framework and assessments for an assigned text chapter. (15% of seminar grade)

High School Student Learning Analysis—You and your school-based experience partner will conduct a case study by taking a close-up look at how students interact with representations in your discipline. You will interview students to learn more about their meaning-making in your discipline, as well as their motivations and dispositions toward the subject area. (15% of seminar grade)

High School Unit of Instruction—You and your school-based experience partner will develop a unit that is focused on a topic, theme, or issue that is central to your discipline and is related to a unit of study observed in your placement classroom. You will create a unit framework and assessments, design two anchor lessons, and teach one lesson and make revisions based on feedback. (20% of seminar grade)

Participation, Attendance, and Punctuality—You will take multiple roles in class by engaging in activities such as: completing in-class writing assignments, participating in discussions, sharing insights from school-based experiences, teaching lessons, evaluating the teaching of others, and participating as a positive and productive community member. Interpersonal skills (e.g., actively working to build relationships 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 professors will assess your participation. (20% of seminar grade)

COURSE READINGS

Course Reader

A course reader (available from the campus bookstore) contains required articles and book chapters. In addition to the assigned readings listed below you will seek out (and the professors will suggest) resources related to the content and teaching issues of concern to you and relevant to the context of your school-based placements.

National Research Council and the Institute of Medicine. (2004). Ch. 2, The nature and conditions of engagement. In *Engaging schools: Fostering high school students' motivation to learn*. (pp. 31-59). Washington, D.C.: The National Academies Press.

Windschitl, M. (2007). What is inquiry? A framework for thinking about authentic scientific practice in the classroom? In J. Luft, R. L. Bell, & J. Gess-Newsome (Eds.) *Science as inquiry in the secondary setting*. (pp. 1-20). Arlington, VA: National Science Teachers Association.

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. 71-103). Sausalito, California: Center Source Systems.

Kersaint, G. & Chapell, M.F. (2004). What do you see?: A case for examining students' work. *Mathematics Teacher*, 97(2), 102-105.

McGinn, M. & Roth, W.M. (1999). Preparing students for competent scientific practice: Implications of recent research in science and technology studies. *Educational Researcher*, 28 (3), 14-24.

Hiebert, J. et al. (1997). Problem solving as a basis for reform in curriculum and instruction: The case of mathematics. *Educational Researcher*, 25 (4), 12-21.

Anderson, J. R., Reder, L. M., & Somon, H. A. (1996). Situated learning and education. *Educational Researcher*, 25 (4), 5-11.

Wiggins, G. & McTighe, J. (1998). Ch. 1, What is backward design? In *Understanding by design*. (pp. 7-19). Alexandria, VA: Association for Supervision and Curriculum Development.

Wiggins, G. & McTighe, J. (1998). Ch. 5, Thinking like an assessor. In *Understanding by design*. (pp. 63-84). Alexandria, VA: Association for Supervision and Curriculum Development.

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.

Textbook Chapters

Introduction to Algebra

Energy

Professional Journals

The following professional journals may be helpful to you as you develop lessons, units, classroom practices, and rich classroom environments.

| Mathematics | Science |
|---|-------------------------------------|
| <i>The Mathematics Teacher</i> | <i>The Science Teacher</i> |
| <i>Mathematics: Teaching in Middle School</i> | <i>Science Scope</i> |
| | <i>The American Biology Teacher</i> |
| | <i>The Physics Teacher</i> |
| | <i>Science Education</i> |

Washington State Standards

Washington K-8 Mathematics Standards. (will be distributed in class)

<http://www.k12.wa.us/CurriculumInstruct/mathematics/default.aspx>

Washington State K-12 Science Learning Standards. (will be distributed in class)

<http://www.k12.wa.us/CurriculumInstruct/Science/pubdocs/WAScienceStandardsFINAL.pdf>

Internet Resources

| Organization | Web Site |
|---|---|
| Math Resources | |
| National Council of Teachers of Mathematics | www.nctm.org |
| Washington State Mathematics Council | www.wsmc.net |
| Interactive Mathematics Project | www.mathimp.org |
| Math Forum | www.mathforum.org |
| Ask Dr. Math | http://mathforum.org/dr.math/ |
| Virtual Manipulatives | http://nlvm.usu.edu/ |
| Science Resources | |
| National Science Teachers Association | www.nsta.org |
| Washington Science Teachers Association | www.wsta.net |
| National Science Foundation | www.nsf.gov |
| American Association of Physics Teachers | www.aapt.org |
| American Chemical Society | www.chemistry.org |
| National Association of Biology Teachers | www.nabt.org |
| National Association of Geoscience Teachers | www.nagt.org |
| North American Association for Environmental Education | www.naaee.org |
| Environmental Education Association of Washington | www.eeaw.org |
| Washington State Standards | |
| 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 |

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