

Middle/Secondary Science Methods (Bio/Chem/Phys 440/442) – Spring 2010

Welcome to Secondary Science Methods!

Instructor: Dr. Alison Wallace wallacea@mnstate.edu (note the 'a' in wallacea!)

Office: 407-P Hagen (218) 477-2843

Office Hours: Mon 10:30-11:30; 2:00-3:00 Thurs 9:00-10:30
Tues 9:00-11:00 Fri 9:30-12:00
Wed 10:30-11:30; 2:00-3:00

NOTE: An advance appointment is strongly recommended since committee and research meeting conflicts do come up occasionally and I may not be in my office. Additional times may also be scheduled, just e-mail or call ahead. I check my e-mail first thing in the morning.

Course Description: Materials and methods appropriate for middle/junior and senior high school science classes and laboratories.

Texts / Readings:

Required:

- “Teaching Inquiry Science in Middle and Secondary Schools” by Anton E. Lawson. 2010. Sage Publications, Inc. ISBN: 9781412966658

Recommended:

- National Science Education Standards (<http://stills.nap.edu/html/nses>)
- Minnesota Science Standards (http://education.state.mn.us/MDE/Academic_Excellence/Academic_Standards/Science/index.html)
- Science for All Americans (<http://www.project2061.org/tools/sfaaol/sfaatoc.htm>)
- Project 2061’s Benchmarks For Science Literacy (<http://www.project2061.org/tools/benchol/bolframe.htm>)
- Project 2061 Atlas for Science Literacy ISBN: 0-871-68668-6
- NSTA Pathways to the Science Standards, High School Edition. Ed. Juliana Texley and Ann Wild. 1996. ISBN: 0-87355-144-3
- “How People Learn: Brain, Mind, Experience, and School”. Edited by John D. Bransford, Ann L. Brown, and Rodney R. Cocking, 2000. National Academy Press. ISBN: 0-309-07036-8 (<http://www.nap.edu>)
- “Teaching Tips”. By Wilbert J. McKeachie. 1999. Houghton Mifflin Company. ISBN: 0-395-90345-9

Purpose: The goal of this course is to introduce and reinforce in students a variety of methods of thinking, planning, acting, and reflecting about teaching secondary science so that they can *recognize* effective science teaching practices and *begin* to incorporate these practices into their own evolving science teaching philosophies.

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Course Objectives: *By the conclusion of the course, students will:*

- Understand how effective science teachers know what to teach (content).
- Understand how effective science teachers know how to teach it (pedagogy).
- Understand how effective science teachers know their students.
- Understand how effective science teachers establish a learning environment.
- Understand how effective science teachers develop as professionals.

MSUM Conceptual Framework: See attached sheet and *read carefully*. This course is designed to be taught and learned within the context of this conceptual framework. You will be expected to demonstrate your fulfillment of the expectations detailed in the conceptual framework in this course. Use the following websites as well to learn more about what is expected of you as a teacher candidate.

Standards of Effective Practice: <http://www.revisor.leg.state.mn.us/arule/8710/2000.html>

INTASC Standards:

http://www.ccsso.org/projects/Interstate_New_Teacher_Assessment_and_Support_Consortium/

Course Requirements:

UNITS: There are six units in this course, and a variable amount of informal, mini-assignments in each unit. A reflection paper will be required of each unit at the end of the semester as part of your final.

- 1) Knowing Yourself
- 2) Knowing Content
- 3) Knowing Pedagogy
- 4) Knowing Students
- 5) Establishing a Learning Environment
- 6) Developing as a Professional

PROJECTS: There are six projects in this course for the 440 students and 4 projects for the 442 students (in italics)

- 1) *Science Olympiad Planning and Participation*
- 2) *Western Regional Science Fair Judging*
- 3) *Summer Science Camp Recruitment – (only 442 students)*
- 4) *Unit of Instruction*
- 5) Red River Area Learning Center Lesson
- 6) Student Academic Conference Workshop Presentation
- 7) Minnesota Science Teacher Association Conference Presentation

Evaluation:

The variable number of informal, mini-assignments for each unit will be evaluated by a ✓+, ✓; or ✓- system and will fall under the Reflection category. They must all be done and be acceptable (✓+ or ✓) before you will be allowed to write a reflection paper at the end of the semester for each unit.

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There are three parts to your final grade. As each assignment is assigned, rubrics detailing how the points will be awarded will be provided.

| | | |
|--|------------|------------|
| | <u>440</u> | <u>442</u> |
| Preparation: | 30% | 55% |
| • Unit of Instruction | (20%) | (50%) |
| • Mini-assignments | (10%) | (5%) |
| Practice: | 50% | 45% |
| • Science Olympiad Planning and Participation | (10%) | (15%) |
| • Western Regional Science Fair Judging | (10%) | (15%) |
| • Summer Camp Recruitment | | (15%) |
| • Red River Area Learning Center Lesson | (10%) | |
| • Student Academic Conference Workshop | (10%) | |
| • MNSTA Presentation | (10%) | |
| Reflection: (Final) | 20% | |
| Write a comprehensive paper that demonstrates your understanding of research-based science teaching best practices in each of the following areas: | | |
| ○ Knowing Yourself | | |
| ○ Knowing Science | | |
| ○ Knowing Pedagogy | | |
| ○ Knowing Students | | |
| ○ Establishing a Learning Environment | | |
| ○ Developing as a Professional | | |

Grading scale (based on overall percentage)

| | | | | | |
|----|-----------|----|-----------|----|-----------|
| A | 93 - 100 | B- | 80 - 82.9 | D+ | 67 - 69.9 |
| A- | 90 - 92.9 | C+ | 77 - 79.9 | D | 63 - 66.9 |
| B+ | 87 - 89.9 | C | 73 - 76.9 | D- | 60 - 62.9 |
| B | 83 - 86.9 | C- | 70 - 72.9 | F | below 60 |

Class Schedule: This course meets Tuesdays and Thursdays from 7:30 – 8:45 in Hagen Hall, room #404.

Other Important Information:

Missed Classes: Your absence will be noticed and you are expected to contact me ASAP if you ever miss a class to explain your absence. Just as you will be expected to show up in your classroom when you are a teacher (even if you are tired, under-prepared, or your car breaks down) you will be expected to show up to contribute whatever you can to our learning community.

Missed Assignments: Each large assignment is of utmost importance to your future as a science teacher. If you cannot complete an assignment for some reason, then you must talk with Dr. Wallace and arrange a substitute assignment.

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Late Assignments: First of all, due dates for large assignments will be negotiated and agreed upon in class. If you know you are in trouble and may be late with an assignment, it is possible to negotiate a new due date with me, but only if you do so before the original due date. If you just turn in a late assignment without renegotiating with me, it will be accepted only if I have not yet begun to grade the others that were turned in on time.

Tips for Success: Come to class; keep up on your readings; be an active learner full of questions! E-mail, stop by, or call me whenever you need help.

Special Accommodations: Students with disabilities who believe they may need an accommodation in this class are encouraged to contact Greg Toutges, Coordinator of Disability Services at 99-5859 V/TTY, CMU 222, as soon as possible to ensure that accommodations are implemented in a timely fashion.

Tentative Course Schedule

****442 attendance required (first 6 weeks)**

| Week | Topics/Activities/Events | Projects | StEP | 8710.4750 subpart 3 E |
|-----------------|--|---|--|--|
| **1/12- 1/14 | Vision for your science classroom Your concerns Card-sorting activity | <i>Assign Science Olympiad Project</i> Your future classroom mini-assignment Your teaching philosophy mini-assignment | | |
| **1/19- 1/21 | Your first job – Now what do you do? What do science teachers need to know? Check the MNBOT standards! What do scientifically literate people need to know? What is inquiry? | MNBOT standards mini-assignment | | |
| **1/26- 1/28 | Which standards do I use?? All of them!! Overview of NSES, 2061, and MN science standards Three types of hands-on. | NSES mini-assignment | | 1a, 3, 4, 5 |
| **2/2- 2/4 | What are the 5E's? How do they help me teach and students learn science? Where do I find standards-based curricula? | <i>Assign Unit of Instruction and Lesson Plan</i> | 4H, 7C, 7D, 7E, 7F, 8A, 8E, 8F, 8G, 8I, 8K | 1a, 1b, 1c, 1d, 2e, 2f, 3, 4, 5, 6, 7, 9, 10 |
| **2/9- 2/11 | Tuesday – Check up on Science Olympiad plans Thursday – Student Academic Conference applications due Friday – Science Olympiad Events | Science Olympiad Plan and Set-up due | | 2e, 7, 11 |
| **2/16- 2/18 | Tuesday and Thursday – Science Olympiad Presentations | Science Olympiad Report due | 8H, 8J, 8K | |
| **2/23- 2/25 | Who has scientific misconceptions? Transform any lesson into a 5E lesson | <i>Assign Science Fair Judging</i> | | 1d, 3, 4, 5, 6, 7 |

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|-------------|---|--|----------------------------------|----------------|
| | Saturday, 2/27 – Western Regional Science Fair Judging from 8am - Noon | | | |
| 3/2-3/4 | Practice lessons from your unit | Science Fair Reflection due 5E class critiques mini-assignments | 2G, 8I | |
| 3/9-3/11 | Practice lessons from your unit | <i>Assign RRALC lessons</i> 5E class critiques mini-assignments | | 2e, 7, 11 |
| 3/16 – 3/18 | Spring Break | | | |
| 3/23 – 3/25 | Unit work time – 2 groups to RRALC | <i>Assign Final project</i> | | 4 |
| 3/30 – 4/1 | Unit work time – 2 groups to RRALC | | | |
| 4/6-4/8 | How do I know they “got it”? Assessment strategies for science classrooms | RRALC Lesson Due <i>Assign SAC lesson</i> | 8A, 8E, 8F, 8G, 8H, 8J, 8K | 1d, 2e, 7, 11 |
| 4/13-4/15 | Tuesday and Thursday – TBA Friday, April 16th – Travel to Brainerd for the MNSTA Conference (reserve Saturday too in case we find funds to stay overnight) | <i>Assign MNSTA project</i> | | 2e, 8 |
| 4/20-4/22 | Tuesday, April 20th – Student Academic Conference Presentations Thursday - TBA | Student Academic Conf. Reflection due First draft of Final due | 8H, 8J, 8K | |
| 4/27-4/29 | Safety – what kinds are there to consider? Ethics – live specimens and collections Controversial issues in the science classroom | MNSTA Reflection due Units of Instruction due Safety mini-assignment | | 2a, 2b, 2c, 2e |
| 5/4 | IEPs and ELLs Your first teaching job | | | |
| Finals Week | | Final due | | |

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CONCEPTUAL FRAMEWORK OF THE EDUCATION UNIT

Candidates are professionals who are knowledgeable, reflective, humanistic, and creative.

Knowledgeable: MSUM candidates display competence in their subject matter, built upon a strong grounding in liberal studies. MSUM candidates understand the principles of learning, assessment and technology. They understand and apply legal and ethical considerations in all aspects of their work. MSUM candidates are able to integrate theory and practice, and view learning as an active process. MSUM candidates demonstrate the ability to model connections between philosophical foundations and best practices in the field. As life-long learners, MSUM candidates engage in research and complex thinking. They design opportunities for others to seek knowledge and to understand themselves as members of the world community.

Reflective: MSUM candidates engage in thoughtful analysis of the meaning and significance of their actions, decisions, and results with regard to their work in order to assess progress in meeting this guiding principle. It is through this reflective process that instruction is improved, new ideas are implemented, ineffective methodologies are abandoned, and learning outcomes for students are enhanced. MSUM candidates are skilled at analyzing their teaching from a variety of perspectives and identifying connections between teaching strategies and student learning. In addition, candidates utilize a variety of techniques to question their procedures and consider alternatives for instruction and student growth. MSUM candidates are able to recognize learning, motivational, and developmental variables in their instructional practice and relate those dimensions to their teaching practices. Finally, MSUM candidates bring a questioning spirit to received wisdom and conventional practice when needed.

Humanistic: MSUM candidates value the personal worth of each individual. This is based on a belief in people's potential and innate ability to develop to their fullest. MSUM candidates' actions are grounded in knowledge of different cultural and ethnic groups within the world community, and in knowledge of the influence of culture and history, ethnicity, language, gender and socio-economics on one's life. This knowledge base informs candidates' decision-making as they create environments that promote freedom, compassion, and success for all learners. MSUM candidates are fair-minded in their interactions with others, as well as sensitive to and accepting of individual differences. Further, MSUM candidates have an understanding of aesthetics and the diversity that is part of the human experience and will incorporate this knowledge into their work. MSUM candidates recognize and accommodate a variety of linguistic and nonlinguistic interpersonal skills in their actions with others. MSUM candidates foster resiliency in the students with whom they work, and model these qualities in their own work.

Creative: MSUM candidates understand the powerful resources of the arts and sciences, and use their knowledge of these areas to bring the best of their imaginative and creative acts into the classroom. MSUM candidates recognize the important role creativity plays in the design of instruction and classroom environment. They will, for themselves and for their students, meet new situations with resourcefulness, excitement and curiosity, with an investigative attitude, and with the ability to pose, seek and design solutions to problems. MSUM candidates are cognizant of the aesthetic elements of the world and draw on that knowledge to make curricular decisions designed to help students not only learn about aesthetics, but to also learn how to think about the world at large.