Introduction to Physics for K-8 Teachers

Course Information
Department and course number: SCI595 and C&I595
Credits: 4
Course meeting dates and times: June 15th – 19th and June 22nd – 26th from 8:30AM to 4:30PM
Course location: University of Montana (CHCH304, CHCB229, and CHCB348)

Course Instructors	e-mail	Office	Phone
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Course Description
The primary focus of this course is on the deepening of K-8 inservice teachers' understanding of fundamental concepts associated with physics. Teachers enrolled in the course will engage in a variety of learning experiences designed to investigate motion, forces, and their applications in everyday life. Topics explored will align with the National Science Education Content Standards (NSES) and will include classroom and laboratory based instructional methods.

The secondary focus of the course is on the development of teacher professional knowledge and skills that support rigorous K-8 science instruction, including pedagogical methods, cultural competency and teacher leadership. Teachers will develop proficiency in these areas of science teaching through critical examination of science education issues and the research literature, professional discourse with course participants including instructors, and the production and sharing of artifacts such as culturally competent science lesson sequences and science teacher leadership plans. Course activities will model effective instructional methods and assessments, providing opportunities for teachers to experience, critique, and adapt activities and methods for use in their own classrooms.

Course Learning Outcomes
Through the successful completion of this course teachers will
1) deepen their understanding of physics knowledge,
2) improve their ability to use scientific skills employed in this field,
3) improve their understanding of the nature of science and how scientific knowledge is generated,
4) heighten their awareness of the interaction of science and society,
5) improve their ability to use educational technology that supports physics education,
6) gain professional skills and knowledge that support the design and implementation of rigorous science instruction,
7) improve cultural competency in teaching American Indian students,
8) improve their ability to use the Montana Science Standards to guide instruction and
9) develop skills as science teacher leaders.

Course Materials

Books

Robertson, W. & Diskin, B. 2002. *Force and Motion: Stop Faking It! Finally Understanding Science So You Can Teach It.* Arlington, VA: National Science Teachers Association Press.

Supporting Materials

Articles & handouts will be provided by the course instructors, including, but not limited to:

Dykstra, D. 2001. *Powerful Ideas in Physical Science: Force Unit Student Materials.* American Association of Physics Teachers.

Dykstra, D. 2001. *Powerful Ideas in Physical Science: Motion Unit Student Materials.* American Association of Physics Teachers.

Windschitl, M. 2009. *Cultivating 21st Century Skills in Science Learners: How Systems of Teacher Preparation and Professional Development Will Have to Evolve.* Paper presented at the National Academies of Science Workshop on 21st Century Skills, February 5-6, 2009.

Notes

Students will receive their texts prior to the course and will be assigned pre course readings.
Students will also receive a thumb drive with supporting digital materials.

Course Content

Week 1: Motion	
Day	**Topics and Activities**
Day 1	Course Welcome, Introduction, Expectations and Theme
	Physics Teacher Pretest and Cultural Competence Survey
	PIPS Motion Investigation 1: Position (Sci Assess 1)*
	Intro to Class Journal 1: The Science Journal
Day 2	Physics Review / Q&A Time
	PIPS Motion Investigation 2: Speed (Sci Assess 2)
	Class Journal 1 Time
	Inquiry Learning Cycles (Guest Randy York)
	Intro to Class Journal 2: The Pedagogy Journal
Day 3	Physics Review / Q&A Time
	PIPS Motion Investigation 3: Acceleration (Sci Assess 3)
	Class Journal 1 Time
	Games for building stamina, endurance, resiliency, cooperation (Guest Mary Jane Charlo)
Day 4	Physics Review / Q&A Time
	PIPS Motion Investigation 4: Cars on Ramps (Sci Assess 4)
	Class Journal 1 & 2 Time
	Science Teacher Leadership 1 (Guest Lisa Blank)
Day 5	Physics Review / Q&A Time
	Projectile Motion Investigation (Sci Assess 5)
	Physics Recap
	Class Journal 1
	Science Teacher Leadership 2 (Guest Lisa Blank)
	History and Demonstration of the Atlatl (Guest Jay Laber)

*"Sci Assess" stands for in-class science assessment to be taken at end of activity.

Week 2: Force	
Day	**Topics and Activities**
Day 6	Physics Review / Q&A Time
	PIPS Force Investigation 1: Examining Ideas About Force (Newton's 1st Law) (Sci Assess 6)
	Class Journal 1 & 2 Time
	Culturally Competent Instruction (Guest Michael Munson-Lenz)
Day 7	Physics Review / Q&A Time
	PIPS Force Investigation 2: Forces on Objects that Move (Newton's 2nd Law) (Sci Assess 7)
	Class Journal 1 Time
	Salish Elder Talk (Guest Louis Adams)
	PIPS Force Investigation 3: Friction and Slowing Down (Newton's 2nd Law)
	Overview of Upcoming Year with BSSP (Including AY course, Scoops, Units, etc.)
Day 8	Physics Review / Q&A Time
	PIPS Force Investigation 3: Friction and Slowing Down (Newton's 2nd Law) (Sci Assess 8)
	Class Journal 1 Time
	PIPS Force Investigation 4: Feeling the Force (Newton's 3rd Law) (Sci Assess 9)
	Class Journal 1 & 2 Time
Day 9	Physics Review / Q&A Time
	Discussion of 21st Century Skills Article
	Unit Framework Intro & Work Time
	Fun with Physics: Movie Physics & Superhero Physics
	Surveys for BSSP
	Class Journal 1
	Unit Framework Time & Science Teacher Leader Time (Instructors Available)
	Class Journal 2 Time (with other lessons)
Day 10	Physics Review / Q&A Time
	Intro to Work and Energy
	Native American Scientist and Science Student Panel (tentative)
	Mary Jane: Closing theme and perspective on teaching science and culture
	Unit Framework & Leadership Planning Time (Instructors, Mary Jane & Michael Available)
	Physics Teacher Posttest
	Course Evaluation/Feedback

Evaluation
Students enrolled in the course will receive a traditional letter grade. Students will be evaluated using multiple methods and all assignments must be completed to at least a minimum standard of proficiency specified by instructors in order to receive a passing grade for the course. All course assignments must be completed by **August 1st.**

Assignments, Due Dates, and Grade Values

Assignment	**Due Date**	**Percent Value**
Science Assessments	See Course Schedule	9@5pt each = 45
Class Journal 1	Each course day except June 26	10
Class Journal 2	June 16, 18, 22, 24, & 25	10
Culturally Competent Physics Unit Framework		25
-Unit Framework (12.5%)	August 1	
-Science Content Background (12.5%)	August 1	
Leadership Plan	August 1	10
Total Possible		*100*

Assignment Descriptions
Science Assessments: Nine short graded science assessments will be completed as indicated in the course schedule.

Class Journal 1: Class Journal 1 will ask students to reflect on and record science concepts (big ideas) addressed during the physics investigations, and to align the concepts with MT Science Standards. The Journal will also provide space for students to take notes during investigations and to submit questions (e.g., muddiest point questions) for instructors each evening. The instructors will use Class Journal 1 to inform the daily Physics Review / Q&A Time. Further instructions for Class Journal 1 will be provided during the course. Students may work in small groups during Class Journal 1 time, but will be required to write and submit individual journal entries. Journals will be graded based on completeness and thoughtfulness (not right/wrong science ideas).

Class Journal 2: Class Journal 2 will focus on pedagogy. The pedagogy journal will ask students to reflect on investigation activities and describe if/how the sequencing of each investigation models elements of an inquiry learning cycle aimed at developing understanding of the science concepts addressed. The journal form will also ask students to reflect on and describe how they would modify the learning sequence if they were to teach this science concept with their own grade level. Further instructions for Class Journal 2 will be provided during the course. Students may work in small groups during Class Journal 2 time, but will be required to write and submit individual journal entries. Journals will be graded based on completeness and thoughtfulness.

Culturally Competent Physics Unit Framework:

Unit Framework: For this course, you will be required to develop a framework for a culturally competent physics unit. The complete unit, with developed lesson plans will not be due until May of 2010 (at the end of the academic year course). The required elements for the initial framework include: unit overview; unit objectives aligned with MT Benchmarks; descriptions of lessons, objectives, assessments, and culturally competent instruction; and science content background (described below and graded separately).

Science Content Background: Students will be required to write a science content background section for their culturally competent physics unit framework. This section will describe and elaborate on the science concepts (big ideas) addressed in the unit. For the unit framework due August 1st, this assignment will consist of one overview description of science content for the entire unit. (For the academic year course, students will also be required to write short science content background sections for each lesson of their unit.) Further instructions for writing the science content background will be provided during the course.

Leadership Plan: Leadership plans detail the plans, progress, challenges and successes that teachers are making with respect to science teacher leader efforts. The leadership plans will be written and submitted in leadership groups (i.e., groups of teachers working together on leadership activities, usually in the same school or district). Further instructions and a leadership plan template will be provided during the course.

Attendance

Regular attendance is expected and recommended in order for students to have access to a rich and comprehensive learning experience. The majority of the course grade is based on in class assignments, therefore regular attendance is also recommended for the successful completion of the course with a passing grade.

Academic Integrity

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/SA/VPSA/index.cfm/page/1321