Science Education 201: Matter and Energy in Physical Systems
Western Washington University, Winter 2016

Class meetings: MWF 12:00 – 1:50 pm in SL240
Instructor: Dr. Andrew Boudreaux (CF 369, 650-7383, andrew.boudreaux@wwu.edu)
Instructor office hours: T, W 3-3:50 pm
Text: “Physics and Everyday Thinking” by Fred Goldberg et al (Its About Time publishing)

Course Overview and Learning Goals
This is a student-centered, lab-based physics course intended primarily for students pursuing a career in K-8 teaching. The course has four major learning goals:

1) **Physics content.** Students develop deep understanding of basic physics concepts and reasoning in order to explain everyday phenomena. Topics include those that are covered in the elementary school science curriculum, with a focus on the concepts of energy and force.

2) **Learning about learning.** Students develop awareness of how their own ideas change and develop, and how the structure of the learning environment and curriculum facilitates these changes.

3) **Elementary students’ ideas.** Students analyze the thinking of elementary students who are engaged in scientific inquiry, in order to become familiar with common ways of thinking, productive learning resources, conceptual difficulties, etc. that are present in these young students.

4) **Nature of science.** Students develop understanding of the nature of scientific knowledge, including how knowledge is generated within a scientific community, the role of creativity to generate explanations, and the use of evidence to test explanations.

What to expect during class meetings
This is a lab-based course in which students alternate between working through guided activities in small groups and participating in full class discussions. During the small group work, you will make predictions, conduct experiments, complete exercises, and work with computer simulations. During all of these activities, you are expected to discuss your ideas with your partners. The full class discussions will allow you to check, verify, and perhaps modify the ideas from your small group work. Learning is thus student directed, and achieved through collaboration and consensus. There is little or no lecturing. Instead, the instructor will act as a “learning coach,” providing guidance and facilitating your work. The curriculum is designed for you to take charge of your own learning. I hope that you, as a learner, are excited about this approach, but recognize that it may also be scary and/or frustrating at first. I hope you will find that many of the learning and teaching strategies employed in this course are valuable and appropriate for you to use when you begin your teaching career.

General course policies
1) **Internet usage.** Many of the HW assignments require access to the Internet. The instructor will use email and Canvas to communicate with the class; you are expected to check your WWU e-mail account and the Canvas site daily.

2) **On-time attendance and missed classes.** Due to the collaborative nature of this class, it is important to attend all class meetings and arrive on time, prepared to begin at 12:00 noon. Your learning depends on being here and participating. In addition, your partners are depending on you. A missed class cannot simply be made up by getting the notes from another student. On-time attendance is required and is worth course credit.
For an absence to be considered excused, you must have a valid reason and contact the instructor prior to class. Valid reasons are: illness, family or personal emergency, or a school related trip (for example, if you are on a Viking sports team that is traveling to a match). Absences that will not be counted as excused include: scheduled dentist or doctor appointments, scheduled family vacations, attending office hours for another class, registering for classes for next quarter, or attending a Woodring admissions interview. Each unexcused absence will drop your course grade by 5%. In addition, a pattern of repeated late arrivals or leaving class early will negatively impact your grade, with a loss of up to 10% of the points for the class. More than three total absences (either excused or unexcused) will prevent a student from receiving credit for the course.

3) Cell phones. Please keep cell phones silenced and put away during class. Repeated cell phone use during class will result in deduction of course credit.

Course work

Inclass Participation. Since you will be generating your own knowledge and understanding in this course, active engagement is essential, both during small group work and during full class discussions. Active engagement includes asking questions, responding to the questions of other students, and offering your own ideas. Participation credit is assigned on the basis of contributions of these types.

Student workbooks. The PET workbook has a sequence of questions and experiments, along with space for students to write observations, inferences, explanations, conclusions, etc. In addition, you will need to add written comments to your workbook based on the full class summarizing discussions that occur at the end of each activity. These comments will describe how you are modifying or adding to your thinking based on the ideas of others in the class. A high quality workbook should thus contain statements of the consensus scientific ideas of the class, as well as the steps that you personally took to come to an understanding of these ideas. The goal of these discussions is for the class to arrive at a consensus understanding of the key ideas. The knowledge agreed upon by the class forms the main body of ideas for the course. Understanding these ideas is crucial for success on the Chapter quizzes. Students are encouraged to take written notes during and after the summarizing discussions. These notes will be a valuable resource for completing HW and preparing for the quizzes.

The main audience for this writing is yourself: the questions and experiments, together with your written answers, forms the textbook for the course. The completed workbook will be your main learning resource for completing your homework, preparing for Chapter exams, and writing end-of-chapter papers. Although the workbook is mainly for you, I must also be able to read your workbook and identify the above parts. Your workbook may be collected one or more times during the course.

Homework. Written homework will be assigned after selected activities. All assignments are due at the beginning of class. In most cases, after checking that you completed the homework, there will be a class discussion of the homework to develop a consensus understanding. Students will be encouraged to make modifications and additions to their homework to improve it, before turning it in. Sometimes, the HW may be collected right at the beginning of class with no class discussion. In either case, all of part the HW will be graded for accuracy and clarity and returned. In some cases, students will have the opportunity to revise the assignment on the basis of the feedback, and earn back any lost credit. The last written HW assignment for the quarter may be due during “Dead Week” (the week before final exams). Please plan accordingly.
Learning commentaries. Before each chapter quiz, you will write a narrative reflection paper in which you retrace your learning of a key physics concept from the chapter. This is designed to help you reflect on how you know what you know, and also on the learning process itself. The learning commentaries are 2 – 3 pages, typed double spaced, with 1” margins and 12 pt font. The learning commentaries will be graded based on a set of criteria that will be posted ahead of time. The last Learning Commentary may be due at the time of the final exam, during finals week (see below), or may be due during “Dead Week” (the week before final exams). Please plan accordingly.

Chapter quizzes. A chapter quiz will be administered at the end of each chapter. These quizzes may have an inclass portion, a take home portion, or both (TBA). Since the course is largely self-paced, dates of quizzes cannot be announced in the syllabus. Quiz dates will be announced ahead of time in class. The final exam for the course is not a comprehensive exam, but instead is simply the chapter quiz for the last chapter we complete. This will occur during the scheduled time for our class during final exams week. (See www.wwu.edu.)

Surveys. You will be asked to complete several surveys at the beginning and end of the course. These will not be graded on the basis of correct or incorrect responses, but you will receive credit for completing them.

Reasonable Accommodation
Reasonable accommodation for persons with documented disabilities should be established through Disability Resources for Students: telephone 650-3083; email drs@wwu.edu; and on the web at http://www.wwu.edu/depts/drs/

Integrity
As a community, Western is committed to integrity in all aspects of academic and campus life. An excellent resource for guiding students is Western’s newly created Integrity website. (See Integrity.) This site is a clearinghouse of resources that encourages and educates about integrity. Besides covering more common problems related to academic integrity, such as plagiarism and cheating on exams, it also addresses ambiguous areas, such as collaborative work, the use of language translators, and submitting the same paper in different classes. In addition to this site, the University Catalog in Appendix D—Academic Honesty Policy and Procedure—delineates rights and responsibilities. (See Appendix D.)
**Course grades**
You final grade will be based on the following components and weighting:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>Inclass Participation</td>
<td>10%</td>
</tr>
<tr>
<td>Homework</td>
<td>30%</td>
</tr>
<tr>
<td>Learning commentaries</td>
<td>10%</td>
</tr>
<tr>
<td>Chapter quizzes</td>
<td>45% total</td>
</tr>
<tr>
<td>Surveys</td>
<td>5%</td>
</tr>
</tbody>
</table>

The scale is as follows:

- 93% A
- 83% B
- 73% C
- 63% D
- 90% A-
- 80% B-
- 70% C-
- 60% D-
- 87% B+
- 77% C+
- 67% D+
- < 60% Fail

**Final comment**
The emphasis of this course is learning through collaboration and consensus—an approach proven effective by extensive research on learning. This approach is how you will be expected to teach with your own students in the future. The approach may be different than science courses you have taken previously. Importantly, mutual respect for everyone is a key to ensuring a safe learning environment in which all students can thrive. If you aren’t sure why I am doing what I am doing, or have concerns about anything related to the course, don’t hesitate to ask! I am interested in talking to you about physics concepts, the nature of learning and teaching, and your personal experience in the course.

*This syllabus is subject to change. Changes, if any, will be announced in class. Students will be held responsible for all changes announced in class.*