

CHM 622 --- Methods in ChmEd Research: Materials Development

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Course Objectives

This is a research-based course is designed to provide you with advanced-level experiences in document and curriculum development in chemistry which are fundamental to the field of chemical education. You will be introduced to the resources and provided with an awareness of the issues involved in developing finished products. To this end, the course will focus on the issues and practical skills necessary to produce quality materials commonly expected of professionals in chemical education, including manuscript review, instructional text including laboratory experiments, journal manuscripts, proposal text and budgets, and proposal reviews.

This is YOUR course. To gain the maximum from it, you must actively participate in all aspects of the course (largely via email or blackboard chat), become involved in trying for yourself, critique each other's work, and learn by doing. The readings, discussion, guest presenters, and assignments are provided to give you opportunities to get involved. To make the most of this class, you must carry out the assigned reading in advance and be prepared to lead and participate in discussions as well as apply the information to real situations.

In summary, you will

- C build on your present writing skills, begin to identify and minimize your weaknesses in writing, and familiarize yourself with resources on grammar, style, and design;
- C become aware of the questions one needs to ask and to think about in materials development, strengthen your ability to perform different levels of edit (from editing for content to proofreading), and identify and apply the steps needed to complete a project;
- C employ techniques related to audience analysis and usability in creating and testing materials;

- C undertake critical reviews;
- C design and prepare advanced materials as expected of professional in chemical education;
- C design and carry out evaluations and tests of the documents you create; and
- C schedule and manage several projects at one time.

Course Requirements and Evaluation

This course will consist of the three major components which are outlined below. Due dates and times for each project will be noted on the schedule and/or provided when the assignment is given. When page length expectations/limitations are stipulated, these are for single spaced documents including graphics if included.

The completed assignment can be emailed, faxed, or hand-delivered to me. Unless otherwise approved, late or incomplete assignments will receive a substantial grade penalty or will NOT be accepted at all. Your work will be evaluated on how well you apply concepts presented or discussed in class or through course readings. Additionally, specific requirements for each project may be provided when it is assigned.

I. Class performance and participation:

You will be expected to actively participate in the course. You are expected to lead and be actively engaged in discussions on the assigned readings and interact with guest presenters. Your grade will be substantially penalized should the quality and quantity of these interactions fall below this graduate-level expectation.

II. Projects will fall under the following categories

A. Basis of modern curriculum & materials developments

1. Standard for grammar, style, and review
 - a. Read through Stunk & White and Dodd (Chap 10). Apply throughout the course.
2. Materials Development protocol
 - a. Review Don Storer's dissertation for a review of the CCE protocol for materials development and testing to be followed in this course.
<http://www.terrificscience.org/research/DonStorerDissertation.pdf>
3. What is constructivism and how does it relate to the teaching and learning of chemistry?

- a. *Assignment 1*: Read the references provided you and any other you find useful. Prepare a 2-3 page position paper that argues what role constructivism has to play in the teaching and learning of chemistry. Write this as if it was to be an invited manuscript to the Journal of Chemical Education. (Site your reference using the ACS style guide.)
 - b. *Assignment 2*: Critique the manuscript written by one of your classmates. Note flaws in content or reasoning, weakness and strengths with the argument, and errors in grammar or style per Strunk & White and the ACS Style Guide (reference these specifically in your critique).
4. What is backward design? (Wiggins, G and McTighe, J.) Apply this method in the development of your inquiry based lab. This is important you will see this again.
- B. Exemplary Curriculum in the 21st century
1. Inquiry-based labs and how they compare to verification labs
 - a. *Assignment 3*: Each student should review an inquiry-based lab from JCE or PACT inquiry-based web collection (each student do a different one)
<http://www.terrificscience.org/lessonexchange/inquiry.shtml#gasintro1>
 Prepare a 1-2 page review explain how it is an inquiry lab and how this differs from verification labs. Document your position citing the literature. Prepare a 10-minute summary of your findings/reviews to present to the class on **Sep 17 in Oxford**.
 - b. *Assignments 4 & 5*: Develop an inquiry-based laboratory to take 2-3 hours of lab time. Carry out a *microtest* of this lab with a novice student from the course for which the experiment is intended or one of your classmates playing this role. Submit a description of your microtest process and results you found. Submit a copy of the beta draft student lab with appropriately annotated to include notes and information for the instructor. This document should be no more than 10 pages long.
 - c. *Assignment 6 & 7*: Critique the completed inquiry lab from one of your classmates send to both the author and AMS. Revise your beta draft to a final draft and turn into AMS.
 2. What is Calibrate Peer Review (CPR)? Review CPR lessons from the CPR library. *Assignment 8*: Critique a CPR lesson to be provided.
 - a. Take of the 4 workshops Dr. Marina Canepa is teaching on CRP:
 F Sep 27 or S Sep 28 or S Oct 5 or
 F & S Oct 18-19 at MUM (1 additional grad credit can be awarded for taking this)

- b. Apply what you learn about CPR to the review of an assigned CPR lesson.
3. What is Peer Lead Teaching and Learning (PLTL)?
 - a. Attend JLS's evening seminar on PLTL as a part of the new grad student seminar series. Ask him question after the seminar or on your own.
 - b. Visit a PLTL help session (arrange with JLS) and write a summary of your observations. Review PLTL questions to be provided by JLS.
 - c. *Assignment 9*: Critique a PLTL question..
- C. Proposal and manuscript writing
1. *Assignment 10*: develop a proposal per criteria of given agency as noted below. Details about the parts of this assignments and deadlines are on the summary assignment page.
 - \$ LTEP for Jerry (submission date Nov 8) on design of curriculum to use wireless palm pilots for information transfer.
 - \$ FISPE for Don project lab for gen chm and chem tech students. From sharks teeth to your teeth.
 - \$ FIPSE for me to fund a toys-on line collaborative with other universities across the US, pulling resources to develop quick-time movies to accompany the lessons, question bank for instructors, and cross-class chatting to expand learning and communication beyond a given institution. This will also involve the evaluation of the method and the site for this national audience. We'll make Don and Phil's schools part of the group.
 - \$ FIPSE for me on combining CPR with Take-home challenges. Write CPR around these take-home / dorm room labs. Test and evaluate learning that results. Use a bridge from HS to college classes.
 - \$ FIPSE for me on combining CPR with PLTL.
 2. (*part of final exam*): Prepare a manuscript for submission to JCE.on the inquiry-based lab you have developed. You must follow the JCE procedures for lab submission but of course the submission will be to me and not to the Editor of JCE. (See Final Exam information below.)

In doing your work be sure to consider:

Manuscript critiques/reviews:

Peer review and the ability to honestly and thoroughly critique another's work is an important aspect of materials development. It is important that you take this part of the course seriously and learn to communicate flaws in content, design, grammar, and style in a constructive fashion. I expect you to be actively involved in soliciting and giving sensitive and carefully considered feedback to your colleagues. I plan to collect samples of your peer critiques/reviews, which I will evaluate for content as well as presentation.

In critiquing the following works of one of your classmates, be sure copy me of what you provide to your classmate. I will review your critique and provide you a grade on it. You will critique the following:

- \$ the role constructivism manuscript
- \$ an inquiry lab developed
- \$ a proposal with budget (pre-submission, but completed draft)

Instructional text:

The audience for these assignments must be clearly defined and understood before an assignment can be undertaken. Unless specifically noted, the audience for all instructional text to be written in the course will be undergraduates in their first or second year of chemistry or chemical technology. These students will to be science majors (but not necessarily chemistry majors). Consideration will be given to modifying this audience to either classroom teachers OR high school students (requests for this should be made in advance of turn in the assignment).

You are expected to follow the CCE protocols for document development and testing, including peer review with one of your classmates and written questions to the instructor as described above. This procedure is described in Don Storer's dissertation (the url was previously emailed to you.) Additionally, you should utilized the method Backward's Design method of Wiggins and McTighe.

Proposal with budget:

Proposal will be prepared including a budget for an original piece of

research or activity as noted above. You cannot propose to do what someone else has already done unless this is an adapt and adopt type of proposal. Keep in mind that proposal writing is a competitive process, so be innovative, document evidence of potential success, and express your ideas clearly and persuasively.

I will assume the role of the funding agencies' project director, and all communication with me should be presented in a professional manor in accordance with this role. My role prevents me from reviewing your drafts in advance of turning them in, but does not prevent me from responding to questions including budget issues posed in well-formulated letters (that can be emailed, faxed, campus mailed, or hand-delivered to me).

If you select MU's LTEP Strategic Improvement Grant the guidelines are available at <http://www.units.muohio.edu/OAST> . You will prepare 2 page abstract (for the Nov 8 deadline—note the actual due date will be about a week prior to this to allow for transmittal procedures through MU), as well as a more detailed 5 page proposal which would subsequently be submitted. (Follow style per previous awards if available or FIPSE (per below). You will work with JLS on the prep and submission. One of your classmates will review your pre-submission drafts. I will serve as the program offer as detailed above.

The FIPSE guidelines can obtain via <http://www.ed.gov/FIPSE/>. In preparation for the actual proposal writing, prepare a 2 page abstract which provides an overview of the proposed activity, need, anticipated outcomes, assessments plans, and estimate of the total costs to be requested. Submit this to me by Nov 8.

§ Final Exam:

The final exam will have three parts.

Part 1: a critique of selected work to be determined.

Part 2: writing of a JCE article on the inquiry-based lab you have developed. You must follow the JCE procedures for lab submission but of course the submission will be to me and not to the Editor of JCE.

Part 3: will cover one or more of the project topics listed above. Details to be provided later in the term.

In completing the final, you will be asked to apply ALL aspects of development, design, grammar, and style that have been presented through the course or its readings as appropriate for the task. However, you are to do your final **INDEPENDENTLY** and **CANNOT** seek assistance from any other person. You cannot seek reviews or use any other critiquing methods that involve input from anyone. It is expected that you will use your own written notes and the written resources from this class.

Summary of Assignments with due dates

Assignment 1: Prepare a 2-3 page position paper that argues what role constructivism has to play in the teaching and learning of chemistry. Send to AMS and peer reviewer. — **due Sep 3 by 11 pm**

Assignment 2: Critique the manuscript on constructivism written by one of your classmates send to AMS and author. — **due Sep 9 by 11 pm**

No Class Sep 10: attend Bassam Shakashiri's presentation at Sharonville Convention Center.

Assignment 3: Each student review a different inquiry-based lab from JCE or PACT inquiry-based web collection <http://www.terrificscience.org/lessonexchange/inquiry.shtml#gasintro1>
Prepare a 1-2 page review paper of an inquiry lab explaining how it follows the key aspects for inquiry and how this differs from verification labs. Document your position citing the literature. Prepare a 10-minute summary of your findings/reviews to present to the class on **Sep 17 in Oxford**— **by due to AMS Sep 17 at start of class**

Sep 17 class in Oxford: prepared to present your inquiry-lab presentations

Assignment 4, 5, 6, & 7: develop or revise an existing verification lab into a guided-inquiry lab, micro-test, revise, peer review: You must design and carry out a *microtest* of this lab with a novice student from the course for which the experiment is intended or one of your classmates playing this role. Submit a description of your microtest process and results you found.

- alpha draft to project editor (AMS) — **due Sep 29 by 12 noon** –
ams will review for major problems only at this point and will not test;
- revise, micro-test (summarize microtesting process and results to AMS **by Oct 13 by 11 pm**),
- revision lab to beta draft with send to AMS and your peer reviewer; — **due Oct 13 by 11 pm**,
- peer reviews/critiques completed and send to author and AMS — **due Oct 27 by 11 pm**,
- revision to final send to AMS— **due Nov 10 by 11 pm**,
- prepare a JCE article on your experiment for submission be sure that Wiggins is referenced in the article — **due Dec 11 by noon** (this is part of the Final Exam.)

Assignment 8 & 9: Critiques of both a CPR lesson and PLTL question send to AMS— **due Nov 26 by 11 pm**

Assignment 10: develop a proposal

- abstract to AMS — **due Oct 21 by 11 pm**
- latest date for question letter to funding agency (ams) **Oct 29 by 11 pm**
- complete draft to classmate for critique — **due Nov 5 by 11 pm**

- d) return critique to author and AMS — **due Nov 19 by 11 pm**
- e) final draft of proposal — **due Dec 8 by 11 pm**