TLT 480: Curricular Design and Innovation

SYLLABUS/COURSE SPECIFICS – Fall 2009

Instructor: Dr. Alec Bodzin	Class meetings: Wed 4:10-7:00 Maginnes 110	Office: A113 Iacocca Hall Hours: Tues 3:00-4:30 and by appt.	Phone: 610-758-5095 Email: amb4@lehigh.edu

Description:
This course investigates curricular models and their features, with a focus on how curricular design promotes learning in K-12 settings. Special emphasis is placed on technology-enabled curricula, designing for learning environments, and curriculum's role in innovation.

Format:
This course is composed of *synchronous* and *asynchronous* activities. Synchronous activities occur live and "face-to-face," while asynchronous activities may take place at different times for different learners. Face-to-face synchronous sessions will be primarily discussion based. Asynchronous activities will include readings, handouts, reviewing online materials, and completing additional activities and materials produced by students. Because some of the content for this course is delivered asynchronously, we are freer in our synchronous sessions to cover application and synthesis of the concepts covered.

Driving course questions:
How can curricular learning experiences be designed to promote deep understanding?
How can technology be used effectively in curricular designs for learning?
What is an innovative curriculum?

Course Objectives:
By the conclusion of the course, students will have demonstrated the ability to (through graded course activities to):
1. Understand how technology can be used in innovative curricular designs for learning environments.
2. Design a technology-enabled instructional unit using backward design to promote learning.

Required Text:
Wiggins, G., & McTighe, J. (2005). Understanding by Design, expanded 2nd Edition. Alexandria, VA: Association for Supervision and Curriculum Development

Optional Text:
McTighe, J., & Wiggins, G. (2004). Understanding by Design Professional Development Workbook. Alexandria, VA: Association for Supervision and Curriculum Development

Course Requirements (with percentage of final mark): <u>All</u> assignments must be completed in order to pass the course.

- Innovative Curriculum Project Paper (50%)

- UBD Instructional Unit Design Assignment (50%)

Evaluation Criteria:

All work will be evaluated in terms of

- **Completeness:** The extent to which it includes all that it should include.

- **Soundness:** The extent to which it is based on a sound theoretical and research foundation.

- **Quality:** Extent to which it demonstrates a firm grasp of material covered in class and in readings.

- **Creativity:** The extent to which it goes beyond mere verbatim reproduction of material presented in class and in readings.

Regular attendance, class participation, and **timely submission** of assignments are expected of graduate students and do not augment assigning marks. All assignments are due no later than the start of class on the date indicated on the syllabus and are to be posted electronically in the form indicated. Late postings will receive reduced marks beginning 1 hour after the due date/time.

Overdue assignments will be marked down 1/2 of a letter grade for each day submitted late. For example, an assignment submitted 1 day late would receive a maximum of an A-/B+ grade. An assignment submitted 2 days late would receive a maximum of a B grade.

Accommodations for Students with Disabilities: If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center 212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

Course Required Readings: (Optional readings are housed and listed in course Blackboard site).
*These readings are embedded in the Innovative Curriculum readings on Blackboard.

Barab, S.A., & Luehmann, A.L. (2003). Building sustainable science curriculum: Acknowledging and accommodating local adaptation. *Science Education, 87*(4), 454-467.

Baker, T. R. (2005). Internet-based GIS in support of K-12 education. *The Professional Geographer 57*(1), 44-50.

*Bednarz, S. W., & D. R. Butler. (1999). "Mission Geography" and the Use of Satellite Imagery in K-12 Geographic Education - A NASA - GENIP Partnership. *Geocarto International, 14*(4), 85-90.

Bodzin, A., Anastasio, D., & Kulo, V. Designing Google Earth Activities for Learning Earth and Environmental Science. (in press). In MaKinster, Trautmann, & Barnett (Eds) *Teaching Science and Investigating Environmental Issues with Geospatial Technology: Designing Effective Professional Development for Teachers*. Springer.

Bodzin, A., Waller, P., Edwards, L., and Kale, D. (2007). Investigating the use of inquiry and Web-based activities with inclusive biology learners. *The American Biology Teacher*, 69(5), 371-377.

Chiarelott, L. (2006). Curriculum in context. Belmont, CA: Wadsworth. pp.57-74; 110-124.

*Clark, D., & Linn, M. C. (2003). Designing for Knowledge Integration: The Impact of Instructional Time. *The Journal of the Learning Sciences, 12*(4), 451-493.

Fishman, B., & Krajcik, J. S. (2003). What does it mean to create sustainable science curriculum innovations? *Science Education, 87*(4), 564-573.

Glatthorn, A.A., Boschee, F., & Whitehead, B.M. (2006). Curriculum leadership: Development and implementation. Thousand Oaks: Sage Publications. pp. 73-104; 301-322.

Hewitt, T. W. (2006). Understanding and shaping curriculum: What we teach and why. 131-153.

Krajcik, J.S., Slotta, J.D., McNeill, K.L., and Reiser, B. J. (2008). Designing learning environments to support students' integrated understanding. In Y. Kali, M.C. Linn, & J.E. Roseman (Eds.) *Designing Coherent Science Education*. New York: Teachers College Press.

Lin, H. T., & Fishman, B. J. (2006, April). Exploring the relationship between teachers' experience with curriculum and their understanding of implicit unit structures. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA.

*Linn, M.C., Clark, D., Slotta, J.D. (2003). WISE design for knowledge integration. *Science Education, Volume 87*(4), 517-538.

Linn, M. C., Davis, E.A., & Eylon, B-S. (2004). The Scaffolded Knowledge Integration Framework for Instruction. In M.C. Linn, E.A. Davis, & P. Bell (Eds.), *Internet Environments for Science Education* (pp. 47-72). Mahwah, NJ: Lawrence Erlbaum Associates.

*Linn, M.C., Husic, F., Slotta, J., & Tinker, R. (2006). Technology Enhanced Learning in Science (TELS): Research Programs. *Educational Technology*, 46(3), 54-68.

National Research Council (2006). *Learning to think spatially: GIS as a support system in K-12 education*. Washington, DC: National Academy Press. p.1-10; 94-109.

Penuel, W.R., & Means, B. (2004). Implementation variation and fidelity in an inquiry science program: Analysis of GLOBE data reporting patterns. *Journal of Research in Science Teaching, 41*(3), 294-315.

Posner, G. (2004). Analyzing the curriculum. 3ed edition. Boston: McGraw Hill. pp.43-65; 69-103.

Rivet, A.E., & Krajcik, J.S., (2004). Achieving Standards in Urban Systemic Reform: An Example of a Sixth Grade Project-Based Science Curriculum. *Journal of Research in Science Teaching, 41*(7), 669-692.

Roschelle, J., Kaput, J.J., & Stroup, W. (2000) SimCalc: Accelerating students' engagement with the mathematics of change. In M. Jacobson and R. Kozma (Eds). Innovations in Science and Mathematics Education. pp.47-75. Mahwah, NJ: Erlbaum.

Readings are posted to our course Blackboard site (bb.lehigh.edu) under "Homework" and organized by week. Students are responsible for completing those materials each week BEFORE class.

Class	Class Meeting Discussion Topics	Before next class: ASYNCHRONOUS (Out-of-class) Always check BB for additions
#1 8/26	Introduction to course. Curriculum overview.	Read: Posner, p. 43-65; 69-103; Chiarelott, 57-74; 110-124; Glatthorn, 73-104; Hewitt, 131-137; 138-150.
#2 9/2	Curriculum and learning theory. Curricular models.	Read Bodzin et. al., in press; Linn et. al., 2004; Krajcik et. al., 2008.
#3 9/9	Instructional design principles and frameworks for learning.	Read Krajcik et. al, 2000; Baker, 2005; National Research Council, 2006.
#4 9/16	Technologies to support learning. Spatial thinking and GIT.	Read Davis & Krajcik, 2005; Lin & Fishman, 2006; Fishman & Krajcik, 2003; Barab, & Luehmann, 2003; Glathorn Ch. 12; Bodzin et al. - Exploring Life articles and instrument
#5 9/23	Educative curriculum materials. Implementation fidelity. Curriculum evaluation. Exploring Life case study.	Read articles and explore Web links in the innovative curriculum folders. Check BB for additions. *Work on Innovative Curriculum Project Assignment*.
#6 9/30	Innovative curricula presentations (4).	Read articles and explore Web links in the innovative curriculum folders. Check BB for additions. *Work on Innovative Curriculum Project Assignment*.
#7 10/7	Innovative curricula presentations (4).	Read articles and explore Web links in the innovative curriculum folders. Check BB for additions. Finish Innovative Curriculum Project Assignment.
#8 10/14	**Innovative Curriculum Project Paper DUE** Innovative curricula presentations (4).	Read articles and explore Web links in the innovative curriculum folders. Check BB for additions.
#9 10/21	Innovative curricula presentations (4).	Read articles and explore Web links in the innovative curriculum folders. Check BB for additions. Read Wiggins & McTighe Ch.1-4; McTighe & Wiggins p. 1- 28
#10 10/28	Innovative curricula presentations. Introduction to Understanding by Design	Read Wiggins & McTighe Ch. 5-8.
#11 11/4	Understanding by Design: • Essential questions and learner understandings • Designing assessments	Read Wiggins & McTighe Ch. 9-11.
#12 11/11	Understanding by Design: Design Processes. Planning learning activities.	Read Wiggins & McTighe Ch. 12-13.
#13 11/18	Understanding by Design: Work session on UBD instructional unit	Work on UBD Instructional Unit Design Assignment.

Class	Class Meeting Discussion Topics	Before next class: ASYNCHRONOUS (Out-of-class) Always check BB for additions
#14 11/25	**Thanksgiving break. No class meeting.**	Work on UBD Instructional Unit Design Assignment.
#15 12/2	**UBD Instructional Unit Design Assignment DUE.** Instructional Design Unit sharing. Course wrap-up and evaluations.	

Innovative Curriculum Project Paper

Each participating student will take the lead in exploring one innovative curriculum project. A list of projects is provided below that includes at least one reading and/or the project Web site to help get you started.

You will be responsible for leading a 35-minute session in which you will present the curriculum project to the class. You will be responsible for identifying key readings and Web-based resources (if available) ten days prior to your session. *Send these to Dr. Bodzin for uploading to Blackboard.*

You will also submit a paper on the curricular project. In exploring the curriculum project, you should consider the following components. Besides reporting on each of these considerations, make sure you also do a critical analysis of each.

I. Design: What is the design of the curriculum project?

In addressing the design, consider the following:

- How does the curriculum promote learning?
- What instructional design principles, instructional models, and/or curricular models are used in the design of materials?
- What types of instructional supports are used?
- How does the curricular project create an authentic (meaningful, important, real world) learning environment for students?
- How does the material accommodate the needs of diverse learners?
- Does the curricular materials provide multiple and varied phenomena to support student learning? If so, how?
- Do materials routinely include suggestions for having students express, clarify, justify, and represent his/her ideas? Are suggestions made for when and how students will get feedback from peers and the teacher?
- What is the role of collaboration?

The following ideas are related to the design aspect but are important enough to lend itself to a distinct area in your paper.

II.   Standards Based: What national standards (e.g., the National Science Education Standards from the NRC, Benchmarks from AAAS, NCTM Standards, Geography for Life) will students meet by engaging in the curriculum? Give specific examples.

III.   Learning Technologies: What learning technology, (if any), is used? What role does the technology play? What are the key features of the technology? How is it used to promote learning?

IV.   Assessment: What assessments are used? What types of feedback do students receive?

Your paper also needs to include a **critical analysis** of the following:

V.   Theoretical Framework: What are the learning and motivation principals/ideas underlying the design of the curriculum and learning materials and held by the authors/designers, either explicitly or implicitly?

VI.   Research: What research has been done? What are the results? What more could be done?

VII.   Dissemination Models: How have the materials been disseminated? What type of professional development has been used? What efforts have been made to scale the materials to a much wider audience? How do the materials support teacher learning?

VIII. Conclusion: What makes this curriculum innovative?

How to Format and Submit Your Report

Your report should be double-spaced in 12-point Times New Roman font with 1" margins all around. All pages of the entire document should be numbered sequentially. Each of the sections of the document should be labeled with the appropriate heading from above and they should be presented in the order that they are presented above. Your report should include a cover page with its own title and the words "TLT 480: Curricular Design and Innovation – Dr. Bodzin" and your name.

Important: Save your document in MS Word version 1997-2003.

Submit your paper using the Assignment Submission tool in Blackboard.

Project List:

1. River City Multi-User Virtual Environment
http://muve.gse.harvard.edu/rivercityproject/
Research publications: *http://muve.gse.harvard.edu/rivercityproject/research-publications.htm*

2. **The Web-based Inquiry Science Environment (WISE)**
http://wise.berkeley.edu
Linn, M.C., Clark, D., Slotta, J.D. (2003). WISE design for knowledge integration. *Science Education, Volume 87*(4), 517-538.

Clark, D., & Linn, M. C. (2003). Designing for Knowledge Integration: The Impact of Instructional Time. *The Journal of the Learning Sciences, 12*(4), 451-493.

3. **Project-based science curriculum/IQWST Investigating and Questioning our World through Science and Technology**
Rivet, A.E., Krajcik, J.S., (2004). Achieving Standards in Urban Systemic Reform: An Example of a Sixth Grade Project-Based Science Curriculum. *Journal of Research in Science Teaching, 41*(7), 669 -692.

Marx, R.W., Blumenfeld, P.C., Krajcik, J.S., Fishman, B., Soloway, E., Geier, R., Revital, T.T. (2004). Inquiry-based science in the middle grades: Assessment of learning in urban systemic reform. Journal of Research in Science Teaching, 41(10), 1063 - 1080.

IQWST - http://hi-ce.org/iqwst/
Research papers: http://hi-ce.org/iqwst/Pages/Papers.html and
http://www.sciencematerialscenter.org/CCMSResearch-CompleteBibliography.htm

4. Technology-Enhanced Learning in Science
http://www.telscenter.org/
http://www.telscenter.org/curricula/
Research publications: http://www.telscenter.org/research/pubs.html
Linn, M.C., Husic, F., Slotta, J., & Tinker, R. (2006). Technology Enhanced Learning in Science (TELS): Research Programs. *Educational Technology*, 46(3), 54-68.

5. Urban Ecology Science
http://urbanecologyscience.org/
Houle, M., & Barnett, M. (2008). Students' conceptions of sound waves resulting from the enactment of a new technology-enhanced inquiry-based curriculum on urban bird communication. Journal of Science Education and Technology, 17(2), 1059-0145.

6. *The Geographic Data in Education (GEODE) Initiative - MyWorld GIS, Learning-for-Use framework*
http://www.geode.northwestern.edu/
http://www.myworldgis.org/
Research Papers: http://www.geode.northwestern.edu/research.htm

7. *Problem-based historical inquiry*
http://dp.crlt.indiana.edu/pihnet-publications.html
See publications by Dr. Thomas Brush (Indiana University) and Dr. John Saye (Auburn University)

8.SimCalc Mathworlds Curriculum
http://www.simcalc.umassd.edu/curriculum/
Publications and technical reports: http://www.kaputcenter.umassd.edu/products/publications/
Roschelle, J., Kaput, J.J., & Stroup, W. (2000) SimCalc: Accelerating students' engagement with the mathematics of change. In M. Jacobson and R. Kozma (Eds). Innovations in Science and Mathematics Education. pp.47-75. Mahwah, NJ: Erlbaum.

9. *Core-Plus Mathematics*
http://www.wmich.edu/cpmp/
Research papers: http://www.wmich.edu/cpmp/bibliography.html

10. Seeds of Science / Roots of Reading
http://seedsofscience.org/
Research papers: http://seedsofscience.org/papers/

11. GLOBE Program
GLOBE Program Web site: http://www.globe.gov/
Penuel, W.R., & Means, B. (2004). Implementation variation and fidelity in an inquiry science program: Analysis of GLOBE data reporting patterns. *Journal of Research in Science Teaching, 41*(3), 294-315.

12*. Think Math!*
http://www2.edc.org/thinkmath/
Papers and presentations: http://www2.edc.org/thinkmath/presentations.htm

13. *Mission Geography*
http://www.missiongeography.org/
Bednarz, S. W., & D. R. Butler. (1999). "Mission Geography" and the Use of Satellite Imagery in K-12 Geographic Education - A NASA - GENIP Partnership. *Geocarto International, 14*(4),85-90.

14. *SEPUP (The Science Education for Public Understanding Program)*
http://sepuplhs.org/
Research papers: http://sepuplhs.org/research.html

15. Technology Enhanced Elementary and Secondary Science II project (TEEMSS)
http://teemss.concord.org/curriculum/
Research papers: http://teemss2.concord.org/publications/ and http://teemss2.concord.org/research/

16. BioKIDS
http://www.biokids.umich.edu/
Research papers: http://www.biokids.umich.edu/about/papers/2009/

17. Engineering is Elementary
http://www.mos.org/eie/
Research findings: http://www.mos.org/eie/research_assessment.php

18. Geology Explorer/Virtual Environments
http://oit.ndsu.edu/menu/
Saini-Eidukat, B. et. al. Geology explorer: Virtual geologic mapping and interpretation. *Computers & Geosciences, 28*, 1167-1176.

Other groups that have research-based curricular projects and publications:

The Concord Consortium
http://www.concord.org/work/projects/
Research publications: http://www.concord.org/publications/detail/

The Center for Curriculum Materials in Science (CCMS)
http://www.sciencematerialscenter.org/
Research publications: http://www.sciencematerialscenter.org/CCMSResearch-CompleteBibliography.htm

Center for the Study of Mathematics Curriculum
http://mathcurriculumcenter.org/
Research publications: http://mathcurriculumcenter.org/reports_publications.php

UBD Instructional Unit Design Assignment

You will create a technology-enabled instructional unit design using the *Understanding by Design* framework. You will use a modified UBD template format for your curricular unit design. The unit should consist of a ***minimum of 13 implementation days*** in a classroom setting for students in a K-12 grade level. Technology should be an integral part of the unit to promote learning.

Adhere to the format below for your instructional unit design submission. Related formats and examples can be found in the Wiggins and McTighe text, p. 327-332, McTighe and Wiggins (2004), and at http://ei.lehigh.edu/eli/energy/framework.html, and http://ei.lehigh.edu/eli/luc/framework.html. UBD Instructional Unit Design examples from previous classes are located on the course Blackboard site in Course Documents.

I. INTRODUCTORY MATERIAL
- Unit Title:
- Grade level:
- Subject/Topic Areas:
- Key Words:
- Designed by:
- Time Frame:
- Brief Summary of Unit (including curricular context and unit goals):
- Technology application(s) used: Describe each technology application that is used in the unit and how it promotes learning.

II. ENDURING UNDERSTANDINGS:
What understandings are desired? Overarching enduring understandings for this unit that transcend the content knowledge of the unit.
Established goals. Include national standards or frameworks.

III. ESSENTIAL QUESTIONS:
What essential questions will be considered? Include overarching questions that point beyond a unit to big ideas and enduring understandings. Do not mention specific topics or events.

IV. TOPICAL QUESTIONS:
Questions about specific topics or events.

V. TOPICAL UNDERSTANDINGS:
These are specific to the unit topic. Involve generalizations derived from the specific content knowledge and skills of the unit.

VI. KEY KNOWLEDGE AND SKILLS
What key knowledge and skills will students acquire as a result of this unit?
Students will know….
Students will be able to….

VI. EVIDENCE – NON-PERFORMANCE TASKS:
What evidence will show that students understand?
For example, tests, quizzes, work samples, observations, or other non-performance tasks.
For each evidence type, address the following:
- What understandings or goals will be assessed through this evidence type?

- What common learner misconceptions (naïve conceptions) or predictable misunderstandings does your assessments specifically address?
- What qualities must student work demonstrate to signify that standards were met?
- By what criteria will student products and performances be evaluated?
- How will assessments be used as formative feedback for students and teachers?
- How will assessments be used as summative feedback for students and teachers?

VII. PERFORMANCE TASKS:

Through what authentic performance task will students demonstrate understandings?
For each performance task, address the following:
- What understandings or goals will be assessed through this task?
- How do students exhibit their understandings through authentic performance tasks? What qualities must student work demonstrate to signify that standards were met?
- By what criteria will student products and performances be evaluated?

VIII. LEARNING EXPERIENCES:

What instructional sequence of teaching and learning experiences will equip students to engage with, develop, and demonstrate the desired understandings? List the key teaching and learning activities in sequence in a daily format. Be specific to how technology is being used to promote learning. This section needs to be written specifically so a classroom teacher could implement the teaching and learning experiences in a classroom environment.

Day 1:
Day 2:
Day 3:
Etc.
(Minimum 13 Days)

IX. LEARNING PLAN EFFECTIVENESS:

How effective is your instructional sequence?
Address the following questions in this section:
- How will students know *where* they're going (the learning goals), *why* the material is important (reason for learning the content) and *what* is required of them (unit goal, performance requirements and evaluative criteria)?
- How will students be hooked—engaged in digging into the big ideas (e.g., through inquiry, research, problem solving, and experimentation)?
- What opportunities will students have to *explore* and *experience* big ideas and receive instruction to *equip* them for the required performances?
- How will students *evaluate* their work, reflect on their learning, and set goals?
- How is the instructional unit *tailored* and *flexible* to address the interests and learning styles of all students?
- How is instruction o*rganized* and sequenced to maximize engagement and effectiveness?

X. DESIGN PRINCIPLES:

Clearly articulate your design principles used for your unit design. Address the following:
• To what extent do your design principles help focus on the big ideas of targeted content?
• How do your design principles help to provoke genuine inquiry and deep thought, and encourage transfer?
Provide specific learning task examples from the unit.

XI. ASSESSMENT EVIDENCE
In this section, you will provide appropriate scoring tools used to evaluate student products, performances, and content understandings.
1. Specific Performance Task Example and Scoring Criteria. Describe in detail one actual performance task the learners would receive. Include at least one analytic trait rubric designed to assess that performance task.
2. Test and Quiz Items. Provide a sample of specific test and quiz items that will be included in the unit to assess content knowledge or process skills. *Include an **answer key** for each item.*

Important: Save your document in MS Word version 1997-2003.

Submit your instructional unit design using the Assignment Submission tool in Blackboard.