

Instructional Trends in Science Education

(SIED 6310 [27875], 2019 Spring)

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Department of Teacher Education

College of Education

University of Texas at El Paso

Class meeting time: Mondays, 5:30 pm –8:20 pm

Class meeting place: Room 305, UTEP Education Building

Instructor: Dr. Pei-Ling Hsu

Office: Room 606, UTEP Education Building

Phone: (915) 747-6446

E-mail: phsu3@utep.edu

Website: <http://peilinghsu.utep.edu>

Office Hours: 2:00pm-5:30pm on Mondays; by appointments

Course Description

This course introduces and discusses various science teaching methods, instructions, pedagogical practices in science classrooms and various aspects of student learning in science. Being able to exercise critical thinking to synthesize and examine current literature and practice is at the core of this course. As a result, students will be able to articulate, evaluate, and examine current science instructions and practices.

Student Learning Outcomes:

The course is designed to help students become competent science educators who understand current science instructions and can examine science instructions critically. At the end of the course, successful students will be able to:

- 1) Explain and appreciate various research-based pedagogical practices of science teaching
- 2) Understand and apply research-based knowledge and skills
- 3) Identify and evaluate various resources to support effective science teaching
- 4) Understand and apply standards for teaching science (Next Generation Science Standards)
- 5) Enact critical thinking on curriculum and science teaching activities
- 6) Conduct critical literature review on science teaching instructions

* Assessment of course objectives will be accomplished by assessing the student's course assignments and participation.

UTEP EDGE Alignments:

This course will help students gain experience of (1) research and scholarly activity, (2) learning communities, (3) creative activity and help students enhance skills of (1) problem-solving, (2) communication, and (3) critical thinking.

Readings and Reflections

- 1) Reading 1: NGSS Lead States. (2013). *Next Generation Science Standards: For states, by states*. Washington, DC: The National Academies Press.
- 2) Reading 2: Posner, G. J., Strike, K. A., Hewson, P. W., Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education* 66(2), 211-227.

- 3) Case A: Trundle, K. C., & Bell, R. L. (2010). The use of a computer simulation to promote conceptual change: A quasi-experimental study. *Computers & Education*, 54, 1078-1088. doi:10.1016/j.compedu.2009.10.012
- 4) Reading 3: Bybee, R., Taylor, J., Gardner, A., Van Scotter, P., Carson Powell, J., Westbrook, A., Landes, N. (2006). *The BSCS 5E instructional model: origins, effectiveness, and applications*. Colorado Springs: BSCS.
- 5) Case B: Tural, G., Akdeniz, A. R., & Alev, N. (2010). Effect of 5E teaching model on student teachers' understanding of weightlessness. *Journal of Science Education Technology*, 19, 470-488. doi: 10.1007/s10956-010-9214-y
- 6) Reading 4: BSCS. 2005. Doing Science: The Process of Scientific Inquiry. National Institutes of Health. Available at http://science.education.nih.gov/supplements/nih6/inquiry/guide/nih_doing-science.pdf
- 7) Case C: Lau, W., Lui, V., & Chu, S. (2017). The use of wikis in a science inquiry-based project in a primary school. *Educational Technology Research and Development*, 65, 533-553. doi: 10.1007/s11423-016-9479-9
- 8) Reading 5: Hung, W., Jonassen, D. H., & Liu, R. (2007). Problem-based learning. In J. M. Spector, M. D. Merrill, J. van Merriënboer, & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (Vol. 1) (pp. 485–506). New York, NY: Lawrence Erlbaum Associates.
- 9) Case D: Senocak, E., Taskesenligil, Y., & Sozbilir, M. (2007). A study on teaching gases to prospective primary science teachers through problem-based learning. *Research in Science Education*, 37, 279-290. doi: 10.1007/s11165-006-9026-5
- 10) Reading 6: Chapter 1 - Kaye, C. B. (2010). *The Complete Guide to Service Learning: Proven, practical ways to engage students in civic responsibility, academic curriculum, and social action* (2nd ed.). Minneapolis: Free Spirit Publishing.
- 11) Case E: Jensen, S., & Burr, K. (2006). Participation and learning relationships: A service-learning case study. *Journal of industrial teacher education*, 43(3), 6-28.

* Additional readings will be made available in classes. These documents play key roles in guiding your assignments and projects. Changes may be made in classes. Please make sure you read these documents in time.

Resources

- Blogger: <http://www.blogger.com>
- WordPress: <http://wordpress.org>
- National Academies Press: <http://www.nap.edu/>
- Next Generation Science Standards (NGSS): <http://www.nextgenscience.org/next-generation-science-standards>
- Assessments Tools in Informal Science (ATIS): <http://www.pearweb.org/atis/>
- Informal Science: <http://informalscience.org/>
- CAISE (Center for Advancement of Informal Science Education): <http://caise.insci.org/>
- Informal Science Education Evidence Wiki: http://iseevidencewiki.org/index.php/Main_Page
- Texas Education Agency (TEA): <http://www.tea.state.tx.us/index.aspx>
- Texas Essential Knowledge and Skills (TEKS): <http://www.tea.state.tx.us/index2.aspx?id=6148>

Assignments

1. Knowledge Enrichment (60%)

In this course, each student will read NGSS and articles on science teaching instructions, write reflections, analyze and discuss cases, and enact critical thinking on science teaching instructions.

(1) Blogging Reading Reflection 1-6 (18%, each reflection is worth 3%)

Each student will post six reflections of corresponding reading (Readings 1, 2, 3, 4, 5, and 6) in discussion blogs according to the schedule. Reflection 1 includes a minimum of 500 words to discuss the following two questions: (1) Why new science standards? Why now? (2) What are some unique features of NGSS that are different from previous standards? For the reflection 2-5 (minimum 500 words for each reflection), each reflection should include (1) summary of the reading with a visual representation, (2) ideas for possible critical literature review (CLR) topics, (3) concerns and questions for the readings or proposals. Each reflection should cite at least 2 references and post the 2 references at the end of each reflection. The titles for the reflection posts should indicate student name and reflection number: "Pei-Ling Hsu - Reflection 1," "Pei-Ling Hsu - Reflection 2," etc.

(2) Responses to Other Classmates' Blogs on the Six reflections (12%, each response is worth 1%)

Each student will respond to at least 2 other classmates' reflections bi-weekly. Each response should: (1) identify merits, (2) suggest ideas for improvements, and (3) end the response with a question. Each week (for reflection 1, 2, 3, 4, 5, & 6), each student will choose 2 different classmates' blogs to respond each time. The due time for responses each week is every other **Friday at 8:00am** and the minimum of a response is 100 words. A record of these responses will be posted and updated in Blackboard. Students should check the record regularly and let the instructor know immediately if there is any question about the updated record.

(3) Case Paper Critique Powerpoint Presentations (30%)

Students will use powerpoint to record their presentation on their critique analysis of case papers for that week's topic: (1) conceptual change, (2) 5E model, (3) science inquiry, (4) problem-based learning, and (5) service learning. The critique presentation (10-15 minutes) should include at least 5 topic-related strengths and 5 topic-related weaknesses on the use of particular instruction methods. Each of the 10 insights (5 strengths and 5 weaknesses) should be supported by at least one quote from scholarly work about this particular instructional method. A presentation powerpoint file should be submitted to the corresponding assignment section through the Blackboard system.

2. Critical Literature Review (CLR, 32%)

(1) CLR Blueprint (4%)

Each student will create a blueprint for critical literature review (CLR) on topics that are related to course topics (i.e., conceptual change, 5E model, science inquiry, problem-based learning, service learning) discussed in the course to design the project proposal. Students are provided with "[Template 1-Blueprint](#)" to fill out. This blueprint for the critical literature review (minimum 1200 words) should be submitted to the corresponding assignment section in Blackboard.

(2) CLR- Introduction (4%)

Each student will draft the introduction section for the critical literature review (CLR) on topics that are related to course topics (i.e., conceptual change, 5E model, science inquiry, problem-based learning, service learning) discussed in the course to design the project proposal. Students are provided with "[Template 2-Critical Literature Review](#)" to fill out. This the introduction section for the critical literature review (minimum 1000 words) should be submitted to the corresponding assignment section in Blackboard.

(3) CLR- Introduction & Method (4%)

Each student will draft the introduction & method sections for the critical literature review (CLR) on topics that are related to course topics (i.e., conceptual change, 5E model, science inquiry, problem-based learning, service learning) discussed in the course to design the project proposal. Students are provided with "[Template 2-Critical Literature Review](#)" to fill out. This the

introduction & method section for the critical literature review (minimum 1700 words) should be submitted to the corresponding assignment section in Blackboard.

(4) CLR- Introduction & Method & Body (4%)

Each student will draft the introduction & method & body sections for the critical literature review (CLR) on topics that are related to course topics (i.e., conceptual change, 5E model, science inquiry, problem-based learning, service learning) discussed in the course to design the project proposal. Students are provided with “[Template 2-Critical Literature Review](#)” to fill out. This the introduction & method & body sections for the critical literature review (minimum 4200 words) should be submitted to the corresponding assignment section in Blackboard.

(5) CLR Draft (4%)

Each student will draft a critical literature review (CLR) on topics that are related to course topics (i.e., conceptual change, 5E model, science inquiry, problem-based learning, service learning) discussed in the course to design the project proposal. Students are provided with “[Template 2-Critical Literature Review](#)” to fill out. This critical literature review draft (minimum 5000 words) should be submitted to the corresponding assignment section in Blackboard.

(6) CLR Draft Evaluation (4%)

Each student will review two other classmates’ critical literature review drafts and provide feedback (minimum 500 words for each review) for improvements. Students are provided with “[Template 3-Critical Literature Review Draft Evaluation](#)” to fill out. Each CLR draft evaluation may include but not limit to (1) praise for merits, (2) identifications of weakness, and (3) ideas and suggestions for improvements. The CLR draft evaluation should be submitted to the corresponding assignment section in Blackboard.

(7) Final CLR Paper (4%)

Students will revise and improve their critical literature review drafts according to the feedback they receive from the instructor and the class. Students are provided with “[Template 1-Critical Literature Review](#)” to fill out. The final CLR paper (minimum 5000 words) should be submitted to the corresponding assignment section in Blackboard.

(8) Final CLR Powerpoint Presentation (4%)

Each student will present his/her final critical literature review in classes (15 minutes presentation, timeframe might be adjusted accordingly later). A presentation powerpoint file should be submitted to the corresponding assignment section in Blackboard and a paper-copy (3 slides per page) of this powerpoint file should be handed in to the instructor before the class on their presentation day.

3. Class Attendance and Participation (8%)

Each week, we have different readings and topics for discussions. Students should be prepared and are expected to participate in the classes actively. Students are expected to attend classes on time, finish assignments, and participate in the course professionally. One attendance form will be available to be signed by individual students during the course. *Students who have more than one absence may be dropped with an “F” (Fail).* Students missing a class are responsible for finding help to catch up with the course, complete any exercises, readings, activities, etc.

Course Requirements:

1. ALL electronic reports should be submitted to the Blackboard system and use WORD files or PPT files. File names should start with “your name” and end with “the assignment name”. There should be no space in between. Taking the name of “Isaac Newton” for example. *Students who do not follow the rules to name files will get a 10% grade reduction.*
 1. IsaacNewton-CaseAPaper.pdf
 2. IsaacNewton-CritiquePresentationOnCaseA.ppt
 3. IsaacNewton-CritiquePresentationOnCaseB.ppt
 4. IsaacNewton-CritiquePresentationOnCaseC.ppt

5. IsaacNewton-CritiquePresentationOnCaseD.ppt
 6. IsaacNewton-CritiquePresentationOnCaseE.ppt
 7. IsaacNewton-CLRBlueprint.doc
 8. IsaacNewton-CLR-Introduction.doc
 9. IsaacNewton-CLR-Introduction&Method.doc
 10. IsaacNewton-CLR-Introduction&Body.doc
 11. IsaacNewton-CLR-Draft.doc
 12. IsaacNewton-CLRDraftEvaluation.doc
 13. IsaacNewton-FinalCLRPaper.doc
 14. IsaacNewton-FinalCLRPresentation.ppt
2. Due time is **12:00AM, Mondays** for ALL electronic submissions except responses to other classmates' blog discussions (due time: 12:00am, Thursdays). Delayed submissions of any assignments will cause grade reductions. One delay day causes 10% reduction of a deserved grade, two delay days causes 20% of a deserved grade, and so on. **All (delayed) assignments have to be submitted before May 6, 2019.** Grading Evaluations: A (90% - 100%), B (80% - 89%), C (70%-79%), D (60%-69%) F (<60%)
 3. Each electronic file of assignments should not exceed 10 MB.
 4. Students are encouraged to take notes during the course for creating one's own learning resources.
 5. The most updated presentation schedule can be found in Blackboard.

Accommodation

If you have a disability and need classroom accommodations, please communicate your needs to the instructor and contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

Standards of Academic Integrity

Students are expected to uphold the highest standards of academic integrity. Any form of scholastic dishonesty is an affront to the pursuit of knowledge and jeopardizes the quality of the degree awarded to all graduates of UTEP. Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are not attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts. Proven violations of the detailed regulations, as printed in the Handbook of Operating Procedures (HOP) and available in the Office of the Dean of Students, may result in sanctions ranging from disciplinary probation, to failing grades on the work in question, to failing grades in the course, to suspension or dismissal among others. You may learn what count as plagiarism in this website: <http://www.plagiarism.org/>

Equal Educational Opportunity

In order to create equal educational opportunities in the class, all students are expected to demonstrate respect for the diverse voices and individual differences in the class. Particularly, no person shall be excluded from participation in, denied benefits of, or be subject to discrimination under any program or activity sponsored or conducted by the University of Texas at El Paso on the basis of race, color, national origin, religion, sex, age, veteran status, disability, or sexual orientation. Any member of the University community who engages in discrimination or other conduct in violation of University policy is subject to the full range of disciplinary action, up to and including separation from the University. Complaints regarding discrimination should be reported to the University's Equal Opportunity Office. Inquiries regarding applicable policies should be addressed to the University's Equal Opportunity Office, Kelly Hall, 3rd Floor, 915.747.5662 or eoaa@utep.edu <<mailto:eoaa@utep.edu>>.

Course Schedule: Changes may be made during the classes. Students should follow the latest changes.

No	Date	Topic	Activities	Assignments Due (12:00am-midnight)
01	Jan 28 F2F	Syllabus review, TEKS, NGSS	Course Introduction & Review Syllabus	
02	Feb 4	NGSS & 3D Learning	Syllabus test, Blog & Reference activities	Reflection 1 (Due: Jan 31) Response 1
03	Feb 11	Conceptual Change	-Blog discussion	Reflection 2 (Due: Feb 7) Response 2
04	Feb 18 F2F	NGSS & Conceptual Change	-Critique Powerpoint Discussions on NGSS, Conceptual change, Case A	Critique Powerpoint on Case A
05	Feb 25 F2F	5E Model	-Blog discussion -Critique Powerpoint -Discussions on 5E Model, Case B	Reflection 3 (Due: Feb 21) Response 3 Critique Powerpoint on Case B
06	Mar 4 F2F	Science Inquiry	-Blog discussion -Critique Powerpoint -Discussions on Science inquiry, Case C	Reflection 4 (Due: Feb 28) Response 4 Critique Powerpoint on Case C
07	Mar 11 F2F	Problem Based Learning	-Blog discussion -Critique Powerpoint -Discussions on 5E Model, Case D	Reflection 5 (Due: Mar 7) Response 5 Critique Powerpoint on Case D
08	Mar 18	(Spring Break)		CLR-Blue print (Template 1)
09	Mar 25 F2F	Service Learning	-Blog discussion -Critique Powerpoint -Discussions on Service Learning, Case E	Reflection 6 (Due: Mar 21) Response 6 Critique Powerpoint on Case E
10	Apr 1	Critical Literature Review	Individual meetings	CLR-Introduction (Templet 2-A&G)
11	Apr 8	Critical Literature Review	Individual meetings	CLR-Introduction & Method (Template 2-A&B&G)
12	Apr 15 F2F	Critical Literature Review	-Discussions on Critical Literature Review	CLR- Introduction & Method & Body (Template 2-A&B&C&G)
13	Apr 22	CLR paper draft	Individual meetings	CLR draft (Template 2-A&B&C&D&E&F&G) – B-Email to everyone
14	Apr 29	CLR paper evaluation	Individual meetings	CLR draft evaluation (Template 3) – B-Email to everyone
15	May 6	CLR Presentation	Presentations and discussions	Final CLR powerpoint Final CLR paper (Template 2-A&B&C&D&E&F&G) UTEP online evaluation

Appendixes:

Grading Rubric for Critique Presentation

		67-100%	34-66%	0-33%
Case study introduction	Coverage	The presentation covers the essences of the case study thoroughly	The presentation covers the essences of the case study partially	The presentation covers the essences of the case study poorly
Critiques of the case study	Fruitfulness	The presentation includes 5 or more topic related strengths and 5 or more topic related weaknesses of the case study	The presentation includes 3-4 topic related strengths and 3-4 topic related weaknesses of the case study	The presentation includes 0-2 topic related strengths and 0-2 topic related weaknesses of the case study
	Validity	All critiques are well supported with quotes to validate arguments and elaborations	A majority of these critiques are well supported with quotes to validate arguments and elaborations	Less than 50% of these critiques are well supported with quotes to validate arguments and elaborations
	Clarity	The presentation is well-structured, clear and easy to follow	The majority of the presentation is unclear and confusing	The presentation has no structure and difficult to follow

Grading Rubric for “Critical Literature Review (CLR)”

Sections	Criteria	Strong (67-100%)	Average (34-66%)	Weak (0-33%)
A.1. CLR title	-Provide an intriguing and succinct title that represents the CLR			
A.2. Audience	-Indicate the audience clearly and appropriately for the CLR			
A.3. Abstract	-Provide a fairly brief overview or a synopsis of the CLR (i.e., issues, methods, findings)			
A.4. Problems or gaps to be addressed in the CLR	-Identify existing issues or gaps that relates to course topics -Draw on research-based findings to address the importance of the project -Articulate the potential of the project to address the existing issues and gaps			
A.5. Relevance to NGSS	-Describe the relevance of NGSS to the CLR -Describe how the CLR may help accomplish NGSS			
A.6. Significances of the CLR	-Describe the importance and potential contributions of the CLR			
A.7. Research question	-Identify a research question ground by research gaps -Establish the research question in broader contexts of an educational topic			
B.1. Criteria for selecting articles	-Describe the criteria and rationale of selecting certain articles for the CLR -Describe the methods of identifying and collecting these articles			
B.2. Strengths and limitations of the scope of the literature	-Articulate the strengths and limitations of the scope of the CLR			
B.3. Methods for analyzing literature review	-Describing and justifying the methods of analyzing the articles collected			
C. CLR body	- <u>Analysis</u> : The findings of CLR are thoughtfully compared, contrasted and/or connected to each other - <u>Relevance</u> : Literature review is well linked to main research question and emergent key ideas - <u>Use of terminology</u> : Correct use of all terminology, attention to nuances of meaning, judicious use of clearly defined jargon - <u>Clarity and organization</u> : Writing is smooth, correct, sophisticated; report has excellent logical flow and very clear descriptions and explanations - <u>Finding synthesis</u> : Patterns (e.g., themes, trends, similarities, difference) or critical stances (e.g., creative thinking, critiques, multiple perspectives, debate) are well-supported by evidence and logical reasoning and presented in a coherent manner - <u>Visual presentations</u> : The findings are illustrated and explained by helpful and easily understood tables and figures			
D. Conclusion	-Summarize the knowledge found from this CLR and relate the knowledge gain to the research question			
E. Implication	-Describe the potential implications of the CLR findings to educational settings			
F. Suggestion for future research	-Provide 3 or more suggestions based on the CLR findings for future research			
G. Reference	-Cite 50 or more references for the CLR and 30 or more of these references are quality, peer-reviewed articles -Format the reference sources in APA style			
Mechanics of English & APA	-Use appropriate expression of concepts, varied and accurate vocabulary, no errors occur with regards to grammar, conventions and spelling. -Follow APA format fully			