



University of Colorado
Denver

School of Education
& Human Development

ELED/SECE 6110/7110
Science and Math Curriculum Studies
Fall 2015

Instructor: Robert “Bud” Talbot, PhD

Location: LSC 600

Time: Face-to-face: 8/20, 9/3, 9/17, 10/8,
10/29, 11/12, 12/3. Remainder online.

Credit Hours: 3

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Office Hours: by appointment

COURSE DESCRIPTION

In this course, we will explore various aspects of science and math curricula. By examining frameworks which bear on curriculum design and development, we will identify and discuss the psychological and philosophical foundations of curriculum design. You will then identify and describe the curriculum that you use or have used in your own teaching, and analyze it with respect to frameworks, standards documents, position statements from professional organizations, and your own beliefs about teaching and learning. Finally, we will work together to identify and describe what science and math teachers need to know and be able to do in order to effectively teach good curricula.

REQUIRED MATERIALS

Textbook: There is no required text for this course. Readings or links to web-based readings will be posted on Canvas and shared in Google Docs.

Materials: Though not required, a laptop computer will be of great use during our face-to-face meetings. For work outside of our face-to-face meetings, you will need a web-enabled device with the ability to record audio and video.

COURSE ESSENTIAL QUESTIONS

- What is curriculum?
- What frameworks exist upon which STEM curricula are based?

- What are the psychological and philosophical foundations of some STEM curricula?
- To what degree are existing STEM curricula culturally responsive?
- What do STEM teachers need to know and be able to do in order to effectively enact good curricula?

COURSE COMPETENCIES/OBJECTIVES

Upon successful completion of this course, all students will be able to:

- Define curriculum.
- Examine and evaluate frameworks which bear on curriculum design and delivery, and synthesize positions based on these frameworks.
- Identify and discuss the psychological and philosophical foundations of curriculum reform frameworks or projects (e.g., NSES, NCTM standards, Project 2061, NGSS, CCSS).
- Describe and discuss the changing emphasis in standards documents, both at the state and national levels.
- Articulate and describe the necessary components of a high-quality STEM curriculum.
- Evaluate curricula with respect to state and national frameworks and standards, and your own beliefs about science or math teaching.
- Articulate and describe the characteristics of effective instruction which support a particular curriculum.

REQUIRED TECHNOLOGY

The course will rely heavily on Canvas. In addition, we will communicate using Slack (<http://slack.com>) which is an advanced and flexible messaging system that works on multiple platforms (Windows, Mac, Android, iOS, etc). You will receive an email (at your UCD address) inviting you to join our Slack team (<https://ucd-stem-curriculum.slack.com>). Other than that initial email, THIS WILL BE AN EMAIL FREE COURSE. Expect to engage in discussions about assignments, activities, readings, etc, and to stay in touch frequently throughout the course using Slack. Virtual office hours will be held through Slack and you should communicate with me using Slack direct messages (DMs) instead of via email. It is imperative that we build a community online so we can all stay engaged. Course assignments will be submitted through Canvas using Google docs formats (preferred) or as pdf files.

GRADING

NOTE: In order to receive a course grade as indicated relative to the point distribution, all required activities and projects must be completed.

94-100	A	80-82	B-
90-93	A-	75-79	C
87-89	B+	74 and below	F

OVERVIEW OF ASSIGNMENTS

1. **"This I Believe"** [Individual assignment] 20% of course grade. You will create a "This I believe" style statement related to your beliefs about teaching and learning science or math. You will write and audio record this as an initial draft (at the beginning of the semester) and as a revised draft at the end of the semester. Your statement could be structured using the following format: "As a science teacher, I believe...I do..." See <http://thisibelieve.org/> for more examples and details. Due week 2 and week 15
2. **Weekly Conversations and Activities** [Individual assignment] 20% of course grade. These are your weekly activities in Canvas. These take different forms depending on the topic: conversations in Slack, artifact analyses, generating position statements, creating presentations for different audiences, interviewing educators, etc. Because these are activities that we would otherwise do in class, any writing assignments are not formal (i.e., they do not need to be highly polished, do not need to conform to APA style, etc.). Details are given in each week's session description on Canvas. Due weekly. **Doctoral Students will be lead facilitators for each weekly activity and conversation**
3. **Curriculum Design and Evaluation**
 - a. **Master's Students: Curricular Material Documentation and Examination- Empirical and Grounded approach [Group assignment]** 30% of course grade. You and your partner will collect and document curriculum materials that you use in your teaching (texts, websites, district materials, etc.). You will then examine these in light of the CO Academic Standards, NSES or NCTM standards, and four of the NSTA or NCTM position statements: Technology, Standards, Teacher preparation and professional development, and equity and diversity. Are these things consistent? What are the psychological and philosophical foundations of the curriculum? **Due week 10**
 - b. **Doctoral Students: Literature Review on the Development of Standards in K-12 STEM Education in the USA and the implications for Curriculum Design- Theoretical Approach. [Individual assignment]** 30% of course grade. In this assignment you will craft an argument for how the design of STEM standards has been shaped by learning theory, and how those standards have in turn influenced curriculum design. Some questions to consider are: What do standards and curricula assume about learners and learning? How are standards consistent or inconsistent with behavioral, cognitive, socio-cognitive, and sociocultural learning theories? How do these underlying assumptions and (mis-) alignments manifest themselves in curricular materials? You should draw heavily on theory, link to curriculum examples, and argue for next steps in standard design. **Due week 10**
4. **Characteristics of Effective Instructional Practices**
 - a. **Masters students: [Group assignment]** 30% of course grade. Based on your analyses of frameworks, standards, position statements, and curricula, you will identify and describe the essential characteristics of effective instructional and assessment practices that support these curricula. In other words, what must a highly qualified teacher know and be able to do to faithfully enact these curricula?

- You will write a formal paper and present your findings in class. **Due week 15**
- b. **Doctoral students: [Individual assignment]** 30% of course grade. Based on the knowledge and skills that you hypothesize a teacher must have in order to enact a specific curriculum (e.g., Next Generation Science Standards), design a small research program to test these hypotheses. This is not a full research proposal that you will actually defend and carry out, but rather a proposal describing all of the components (framing, questions, hypotheses, proposed data collection and analysis methods, resources needed). Think of this as a small grant proposal. More guidance and examples will be given in class. **Due week 15**

COURSE OUTLINE

List the schedule of topics/requirements in this area

Week/Module	Dates	Topics	Assignment # Due
1/Standards	(f2f)	What is curriculum?	
2/Standards	(online)	Why and how were the National science and math standards developed?	#1 "This I Believe" #2 Weekly Activities
3/Standards	(online)	How are the National standards structured and how is that structure evolving?	#2 Weekly Activities
4/Standards	(f2f)	What is the future of STEM standards? Next Gen and Common Core.	#2 Weekly Activities
5/Frameworks	(online)	What curriculum frameworks exist and how are they used?	#2 Weekly Activities
6/Frameworks	(online)	How were each State's standards developed and how do they compare to NGSS and CCSS?	#2 Weekly Activities
7/Frameworks	(f2f)	What curriculum-related positions have professional organizations (NSTA and NCTM) articulated?	#2 Weekly Activities
8/Frameworks	(online)	How are standards, frameworks, and position statements used to develop	#2 Weekly Activities

		and evaluate curricula?	
9/Frameworks	(online)	What are some examples of contemporary curriculum development and reform efforts?	#2 Weekly Activities
10/Responsivity	(f2f)	To what degree are our science and math curricula culturally responsive?	#2 Weekly Activities #3a Master's Students: Curricular Material Documentation and Examination #3b Doctoral Students: Literature Review on the Development of Standards
11/Responsivity	(online)	How could you structure a framework for guiding the development of culturally responsive science and math curricula?	#2 Weekly Activities
12/Instruction	(online)	What is the curriculum that you teach?	#2 Weekly Activities
13/Instruction	(f2f)	How do teachers enact or deliver the curriculum?	#2 Weekly Activities
14 /Instruction	(online)	What do teachers need to know and be able to do to effectively teach your curriculum?	#2 Weekly Activities
15	(f2f)	Presentations of assignment 5	#1 "This I Believe" #4a and #4b Characteristics of Effective Instructional Practices

COURSE READINGS

The following readings are available on the web or will be posted on Canvas. Other readings will be added as appropriate.

American Association for the Advancement of Science (2011), Atlas of Scientific Literacy.
<http://www.project2061.org/publications/atlas/default.htm>

American Association for the Advancement of Science (1996). Identifying Curriculum Materials for Science Literacy: A Project 2061 Evaluation Tool.

<http://www.project2061.org/publications/articles/roseman/roseman2.htm>

American Association for the Advancement of Science (2001). The Trouble with Textbooks.

<http://www.project2061.org/publications/articles/articles/asee.htm>

Bybee, R.W., & Van Scotter, P. (2006). *Reinventing the science curriculum*. Educational Leadership, v64 (4).

Council of Chief State School Offices (2010, June 2). Introduction to the Common Core Standards.

<http://www.cesa11.k12.wi.us/CommonCORE/8-Introduction%20to%20the%20Common%20Core%20State%20Standards.pdf>

Dewey, J. (1964). The Child and the Curriculum. In Archambault, R. (ed.) *John Dewey on Education*. Chicago, The University of Chicago Press.

Egan, K. (1978). What is Curriculum? *Curriculum Inquiry*, 8(1), 65-72.

Hilton, M. & National Research Council (2010).

International Society for Technology in Education (2007). NETS for students 2007.

<http://www.iste.org/standards/nets-for-students/nets-student-standards-2007.aspx>

National Academies, Board on Science Education Board on Science Education (2011).

Exploring the intersection of science education and 21st century skills : a workshop summary.

Washington, DC. National Academies Press. http://www.nap.edu/catalog.php?record_id=12771

Conceptual Framework for New Science Education Standards.

http://www7.nationalacademies.org/bose/Standards_Framework_Homepage.html

Moses, R., Kamii, M., Swap, S., & Howard, J. (1989). The Algebra Project: Organizing in the Spirit of Ella. *Harvard Educational Review*, 423-443.

National Council of Teachers of Mathematics. (2000). Executive Summary: Principles and Standards for School Mathematics.

National Research Council. (1996). *National Science Education Standards : observe, interact, change, learn*. Washington, DC: National Academy Press.

http://books.nap.edu/openbook.php?record_id=4962&page=1

National Council of Teachers of Mathematics position statements

<http://www.nctm.org/about/content.aspx?id=6330&itemid=6330&linkidentifier=ID>

National Science Teachers Association position statements

<http://nsta.org/about/positions.aspx?lid=tnavhp>

Partnership for 21st Century Schools (2010). Curriculum and Instruction: A 21st Century Skills Implementation Guide. http://www.p21.org/documents/p21-stateimp_curriculuminstruction.pdf

Rotherham, A.J., & Willingham, D. (2009). *21st Century Skills: The Challenges Ahead*.

Educational Leadership, v. 67, no. 1, p. 16-21

<http://www.ascd.org/publications/educational-leadership/sept09/vol67/num01/21st-Century-Skills@-The-Challenges-Ahead.aspx>

Rutherford, F. J., & Ahlgren, A. (Eds.). (1990). *Science for all Americans* (New ed.). New York:

Oxford University Press. <http://www.project2061.org/publications/sfaa/online/sfaatoc.htm>

Sneider, C., and Workosky, C. (2009). Critical Issues for Common State Standards

Science Anchors Phase I Final Report.

<http://www.nsta.org/pdfs/ScienceAnchorsPhaseOneFinalReport.pdf>

Stevens, Sidney (2001). *Handbook for Culturally Responsive Science Curriculum*. University of Alaska Fairbanks, Alaska native Knowledge Network.

SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT INCOMPLETE POLICY

Incomplete grades (I) are not given to replace low grades. To be eligible for an incomplete grade, students must (1) successfully completed at least 75% of the course requirements, (2) have special circumstances (verification required) that preclude the student from attending classes and/or completing graded assignments, and (3) make arrangements to complete missing assignments with the original instructor before more than one year has elapsed since the end of the semester in which the course was taken.

SEHD Incomplete Process

1. Students must be in close communication with the instructor PRIOR to the end of the semester regarding special circumstances precluding them from successfully completing the remainder of the course. Faculty may assign students an incomplete grade of "I" to signify that special circumstances beyond the student's control prevented the student from completing a small portion of the course (no more than 25%) and that a final grade cannot yet be assigned.

2. IT IS THE STUDENT'S RESPONSIBILITY TO COLLABORATE WITH THE INSTRUCTOR TO COMPLETE AN INCOMPLETE AGREEMENT FORM (found at www.ucdenver.edu/education under Current Students/Current Student Resources) prior to the end of the semester for which the incomplete is given. A copy of the form, signed by both the

student and the instructor should be submitted to the SEHD Student Services Center (LSC 701). Both the student and instructor should also keep a copy. The instructor sets the conditions under which the course work can be completed and the time limit for completion. The student is expected to complete the requirements within the established deadline. If the missing assignments are not completed within the allotted time, the “I” converts to an F on the student’s transcript. Students making up an incomplete should not re-register for the course.

3. Upon completion of the missing course work, a Change of Record Form is completed by the original instructor to change the “I” to a letter grade. Faculty should work with the Faculty Services Center to complete the Change of Record Form.

ACADEMIC HONESTY

Plagiarism is the use of another person’s words or ideas without crediting that person. Plagiarism and cheating will not be tolerated and may lead to failure on an assignment, in the class, and dismissal from the University. (Refer to School/College guidelines.)

You are responsible for being attentive to or observant of campus policies about academic honesty and all other aspects of student conduct as stated in the University’s Student Conduct Code, located at

<http://www.ucdenver.edu/life/services/standards/Documents/UCD%20Code%202008-2009.pdf>

ACCESSIBILITY, DISABILITY, AND COMMUNICATION

The University of Colorado Denver is committed to providing reasonable accommodation and access to programs and services to persons with disabilities. Students with disabilities who want academic accommodations must register with the Office of Disability Resources and Services (DRS), North Classroom 2514, Phone: [\(303\) 556-3450](tel:3035563450) TTY: [\(303\) 556-4766](tel:3035564766) Fax: [\(303\) 556-4771](tel:3035564771) E-mail DisabilityResources@ucdenver.edu I will be happy to provide approved accommodations, once you provide me with a copy of DRS’s letter.