Science Instruction & Applied Technology

(Expanding the Boundaries of STEM Teaching and Learning for All)
CI 175, Spring 2020

Course Number: CI 175, Section 04	**Instructor:** Myunghwan Shin, Ph.D.
Units: 3	**Office Number:** ED 453
Time: Tuesday, 7 pm – 9:50 pm	**Email:** mshin@csufresno.edu
Location: ED 153	**Telephone:** 559-278-0336
	Office Hours: Tuesday: 4 pm – 7 pm (or by appointment)

Course Overview

This course is designed to help teacher candidates be prepared to engage all students in Science, or broadly Science, Technology, Engineering, and Mathematics (STEM). Teacher candidates will learn contemporary pedagogies, tools, and resources that support K-8 students in not only learning core ideas and practices highlighted in STEM education standards, but also taking informed action, as agents of change, to make differences in their everyday lives or their local and global communities. By recognizing and leveraging students' funds of knowledge, cultural practices, and multiple identities, teacher candidates will learn how to teach STEM for all, including students of color, women, immigrants, students with disabilities, LGBT, and other populations historically underrepresented in STEM fields and formal education systems.

Through contemporary theories of learning and teaching and research-based practices in STEM, teacher candidates will construct their own answers to three key questions below over this semester:

1) What does STEM teaching look like for/with all students?
2) How is STEM taught in an integrated way?
3) What are the core ideas and practices in STEM disciplines K-8 students should know and be able to do?

Course Materials

A list of selected readings is used to replace textbooks in this course (see below). All readings and additional materials will be available online (see Google Classroom). Readings will reflect current research and will support an understanding of STEM Education and its implications for teaching. The understanding of assigned readings should be reflected in course assignments and discussions.

- Czerniak, C. M., & Johnson, C. C. (2007). Interdisciplinary science teaching. In Lederman, N. G., & Abell, S. K. (Eds.). (2014). *Handbook of research on science education (Vol. 2)* (pp. 395-411). New York, NT: Routledge.
- Wilson, S. M., & Peterson, P. L. (2006). Theories of Learning and Teaching: What Do They Mean for Educators? Working Paper. *National Education Association Research Department.*
- Calabrese-Barton, A., & Tan, E. (2009). Funds of knowledge and discourses and hybrid space. *Journal of Research in Science Teaching*, 46(1), 50-73.
- Paris, D. (2012). Culturally sustaining pedagogy: A needed change in stance, terminology, and practice. *Educational Researcher*, 41(3), 93-97.
- Calabrese-Barton, A., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *The Journal of the Learning Sciences*, *19*(2), 187-229.
- CAST: About Universal Design for Learning: http://www.cast.org/our-work/about-udl.html#.W34EA5NKj6Y
- California Next Generation Science Standards: https://www.cde.ca.gov/pd/ca/sc/ngssstandards.asp
- California Common Core State Standards: https://www.cde.ca.gov/re/cc/
- International Society for Technology in Education Standards: https://www.iste.org/standards

Course Requirements & Assignments

Teacher candidate groups will mainly participate in *collaborative inquiries (or research projects)* in which they investigate problems or challenges in STEM education at Central Valley and develop possible solutions to engage all our students in STEM. By participating in collaborative inquires, teacher candidates will construct their own answers to three key course questions. Rubrics, tools, or resources associated with each key assignment will be provided in class**. [TPEs: 1.5, 3.1, 3.2, 6.1]**

1. **Identify Problems: Research Proposals (Group, 100 points)**
   Teacher candidates will write a research proposal that describe their 1) research questions, 2) rationale (why is it important to answer the research question?), and 3) research schedule. Teacher candidates will clearly define "what" change they want to make and "why" it is important for our students.

2. **Investigate: Digital Portfolios (100 points)**
   Teacher candidates will create a digital portfolio that demonstrates the progress of their projects or inquires. Using a cloud-based ePortfolio platform, teacher candidates will upload the following (but not be limited):
   - Raw data collected
   - Findings from data analysis
   - Photo documentation
   - Reflections and notes

3. **Take Actions: STEM Educational Artifacts (Group, 100 points)**

Teacher candidates will create a STEM educational artifact that represents their answers to the research questions posed by their groups. Teacher candidates have a variety of options for their STEM educational artifacts. Those options will be discussed and reevaluated in class with their peers and instructor. While the possibilities are unlimited, some possible options for the STEM educational artifacts include:

- Redesigned STEM textbook chapters
- Co-author storybooks
- STEM education performance or demonstration (e.g., dance, theater, or cooking)
- Public service announcement videos or movies
- Redesigned tools or resources (e.g., makerspaces, STEM education carts, or mini gardens)
- Action plans for community collaborations and partnerships
- STEM community handbooks or resource guides

4. **Share: Final Presentation (Group, 100 points)**
   Teacher candidates will also share their final STEM artifacts with the instructor and their colleagues at the end of this semester. Each group will have a 10-15 minutes presentation

5. **Reflect: Reflection Notes (100 points)**
   Teacher candidates will write about what they learn from collaborative inquiries and how they design their collaborative inquiries or STEM educational artifacts in different ways that respond to needs of their students.

6. **Peer Evaluation (100 points)**
   Teacher candidate contribution to collaborative inquiries will be evaluated by their team members. Each team member will provide feedback on peer contributions based on the rubric provided by the instructor.

7. **Attendance and Class Participation (100 points)**
   Teacher candidates are expected to attend and participate in all class activities. Points will be given for attendance and participation. You will lose 10 points if you do not attend one class. You will lose 5 points if you are late for the class. If you miss over 5 classes, you will not pass this course. You can have additional assignments if you want to make up for the deduction from your excused or unplanned absences (e.g., when you have a short-term serious and compelling medical condition, or when a death or serious illness in the immediate family prevents attending class). In this case, you should contact the instructor and discuss the additional assignments.

Grading Policy

1. Grading Scale
A = 630-700 points (90–100%)
B = 560-629 points (80–90%)
C = 490-559 points (70–80%)
D = 420-489 points (60–70%)
F = below 420 points (below 60%)

2. Late Assignments
Points will be deducted for assignments turned in late—20% for a missed deadline. If you cannot turn in an assignment when it is due, please let the instructor know in writing when you plan to turn it in. All assignments must be completed by **May, 12.**

Course Goals and Learning Outcomes

The learning outcomes are aligned with the Teaching Performance Expectations (TPE) within the California Standards for the Teaching Profession approved by the California Commission on Teacher Credentialing.

Key Course Goals and Learning Outcomes	**TPEs**
Teacher candidates will learn to engage ALL students in STEM learning and activities based on their unique learning, development, and cultural knowledge. Candidates will be able to define the "who" in ALL students utilizing a culturally responsive and equitable framework.	**1.1, 1.3, 1.8, 2.1, 2.2, 2.3, 4.1**
Teacher candidates will construct their own answers to STEM problems of practice through inquiry, investigation, and reflection. Candidates will understand how STEM teaching and learning is afforded through the demonstration of knowledge and assessment.	**1.5, 1.7, 1.8, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 6.4,**
Teacher candidates will become familiar with modern STEM pedagogies, tools, and resources that will support optimal STEM learning and experiences in K-8 classrooms.	**1.4, 1.6, 2.5, 3.6. 3.7, 4.4, 4.6, 4.8, 5.7**
Teacher candidates will develop an understanding of STEM education standards, integration, and the application of core ideas and practices.	**3.1, 3.2, 3.3, 3.4, 3.5, 3.8, 4.3**
Teacher candidates will work with K-8 students to take informed action as agents of change in their local and global communities.	**1.3, 4.7, 6.4, 6.5, 6.6**

Course Schedule

Date	Topic	Assignment
1/21	● Syllabus Overview ● Setting up Google Classrooms	
1/28	**Phase I: Identify Problems** ● Why STEM Teaching for/with All? ● Why integrated STEM? ● Mini Lesson: Earthquake in the Classroom ● Forming Project Teams & Brainstorming	
2/4	● What K-8 students should know and be able to do in STEM? (NGSS, CCSS, & ISTE) ● Mini Lesson: Moonky's Balloon Powered Car!	

	● Defining Problems/Challenges in STEM Education I	
2/11	● Funds of Knowledge, Hybrid Space, & Culturally Sustaining Pedagogy I ● Mini Lesson: My Family's Salad Recipe! ● Defining Problems/Challenges in STEM Education II	
2/18	● Identity, Agency, & Social Justice Pedagogy ● Mini Lesson: Choice, Control, & Change (Fat & Sugar in Foods) ● Planning Investigations I	
2/25	● Planning Investigations II	**#1 Research Proposal**
3/3	**Phase II: Investigate** ● Navigating Contemporary STEM Instructional Tools & Resources I: Video Taking/Editing Software & Educational Mobile Apps ● Peer Feedback on Research Proposal ● Conducting Investigations I	
3/10	●Navigating Contemporary STEM Instructional Tools & Resources II: Virtual/Augmented Reality ●Conducting Investigations II	
3/17	●No Class (Conference)	
3/24	●Navigating Contemporary STEM Instructional Tools & Resources III: 3D Computer Modeling & 3D Printing ●Analyzing the Data I	
3/31	●No Class (Cesar Chavez Day)	
4/7	●No Class (Spring Break)	
4/14	●Navigating STEM Instructional Tools & Resources in My Community I (e.g., Chaffee Zoo, Botanical garden, FS Teacher Resource Center, INTERESC, Ideaworks Makerspace, community STEM experts, etc.) ●Analyzing the Data II	**#2 Digital Portfolio**
4/21	**Phase III: Take Actions** ●Developing Solutions I	
4/28	●Navigating Contemporary STEM Instructional Tools & Resources IV: Coding & Robots ●Developing Solutions II	
5/5	**Phase IV: Share & Reflect** ● Final Presentation I ● Reflection I	**#3 STEM Artifact** **#4 Final Presentation**
5/12	● Final Presentation II ● Reflection II	**#5 Reflection Note** **#6 Peer Evaluation**

*** Final presentation preparation and faculty consultation days: May, 7-8**

*** Subject to Change:** This syllabus and schedule are subject to change. If you are absent from class, it is your responsibility to check on announcements made while you were absent.

University Policies

Students with Disabilities: Upon identifying themselves to the instructor and the university, students with disabilities will receive reasonable accommodation for learning and evaluation. For more information, contact Services to Students with Disabilities in the Henry Madden Library, Room 1202 (278-2811).

Honor Code: "Members of the Fresno State academic community adhere to principles of academic integrity and mutual respect while engaged in university work and related activities." You should:

1) understand or seek clarification about expectations for academic integrity in this course (including no cheating, plagiarism and inappropriate collaboration)
2) neither give nor receive unauthorized aid on examinations or other course work that is used by the instructor as the basis of grading.
3) take responsibility to monitor academic dishonesty in any form and to report it to the instructor or other appropriate official for action.

Cheating and Plagiarism: Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term 'cheating' not be limited to examination situations only, but that it include any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work. Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an F for the course, to expulsion from the university. For more information on the University's policy regarding cheating and plagiarism, refer to the Class Schedule (Legal Notices on Cheating and Plagiarism) or the University Catalog (Policies and Regulations).

Disruptive Classroom Behavior: "The classroom is a special environment in which students and faculty come together to promote learning and growth. It is essential to this learning environment that respect for the rights of others seeking to learn, respect for the professionalism of the instructor, and the general goals of academic freedom are maintained. Differences of viewpoint or concerns should be expressed in terms which are supportive of the learning process, creating an environment in which students and faculty may learn to reason with clarity and compassion, to share of themselves without losing their identities, and to develop an understanding of the community in which they live. Student conduct which disrupts the learning process shall not be tolerated and may lead to disciplinary action and/or removal from class."

Make Up Policy for Planned and Unplanned Absences: In the case of an unplanned student absence, papers, tests, and/or homework assignments due during the time the student is absent may be made up only if the student contacts the instructor as soon as practicable after the absence occurs and works out a plan. In the case of authorized absences due to university-sponsored activities, students should expect to submit their work to the instructor on or before

the due date, or as arranged with the instructor. This includes papers, tests, and/or homework assignments. See grading policy in syllabus for additional information.

When a student is absent for an extended time period, a viable make-up plan may not be feasible. In these circumstances, other options such as dropping the class for a serious and compelling reason or withdrawal from the university may be appropriate.

Computers: "At California State University, Fresno, computers and communications links to remote resources are recognized as being integral to the education and research experience. Every student is required to have his/her own computer or have other personal access to a workstation (including a modem and a printer) with all the recommended software. In the curriculum and class assignments, students are presumed to have 24-hour access to a computer workstation and the necessary communication links to the University's information resources."

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