# **EDUC X318: Single Subject Methods - Science (3 units)**

*UC Merced Extension Education Programs has developed a plan for preparing teachers, which is defined by our Mission and Vision statements and is aligned with the Teacher Performance Expectations (TPEs) and the California Standards for the Teaching Profession (CSTP)****,*** *developed by the California Commission on Teacher Credentialing (CTC).*

**Mission**

The UC Merced Teacher Preparation Program exists to develop culturally responsive educators who equitably facilitate cross-disciplinary, integrative learning to catalyze student potential and empowerment.

**Vision**

The UC Merced Teacher Preparation Program aspires to be a recognized model for developing culturally responsive teachers who are committed to empowering their students. The Teacher Preparation Program is aligned with the vision of the University of California, Merced—upholding 21st century priorities for interdisciplinary learning and public service. To achieve this aspiration, the Teacher Preparation Program:

1. Aims to establish culturally respectful communication regarding questions, ideas, and solutions in the context of the Teacher Preparation Program courses and clinical placements.
2. Aims to nurture collaboration between teacher candidates and students to achieve learning goals, maximizing collective talent and expertise.
3. Aims to develop skills for critical and creative problem-solving among teacher candidates and students, applicable to all content domains.

**Extension Education Programs Learning Outcomes (EPLOs)**

The Teacher Preparation Program mission and vision are embedded in our Extension Education Programs Learning Outcomes (EPLOs). Teacher candidates graduating from the Teacher Preparation Program will be able to:

**Cultural Responsivity and Values (CRV):** demonstrate awareness, sensitivity, and responsiveness to diversity in every domain of learning, understanding values as opportunity for respectful exchange, collaboration, and shared commitment to the greater good.

**Content Knowledge (CK):** master state standards in the arts, humanities, language, literature, mathematics, physical science, natural science, and applied science along with capacity to monitor and guide personal learning.

**Communication and Information Literacy (CIL):** effectively convey information, engage in respectful dialogue, and share ideas through oral and written discourse, cultivating inquiry inclusive of self, other, and community.

**Professional Development (PD):** deploy problem-solving skills capable of transforming classrooms, promoting justice, fostering collaborative leadership, and addressing community concerns with mature civic identity.

**The Teacher Preparation Program Learning Outcomes (PLOs)**

Candidates (students) who complete the Teacher Preparation Program will be able to:

1. Develop a philosophy of education which uses theory to collaboratively guide practice, attending to the cultural and socio-emotional dimensions of teaching.
2. Personalize instruction and develop co-teaching models.
3. Develop lesson plans and deliver effective cross-disciplinary content, deploy appropriate assessments, distinguish between students of differing abilities, and apply learning-enhancing technologies to promote student potential and empowerment.
4. Practice restorative justice and authentic care.
5. Nurture and educate English language learners through an inclusive and positive class environment.
6. Develop critical and creative problem-solving for student empowerment across all academic subjects and content domains.
7. Communicate effectively through oral, visual, and written means with a wide range of audiences, including colleagues, families, and the community.

Finally, the *Teacher Performance Expectations (TPEs),*developed by the California Commission on Teacher Credentialing (CTC), and aligned with the California Standards for the Teaching Profession (CSTP) define how we formatively and summatively assess candidates.

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| **TPE 1:** Engaging and Supporting All Students in Learning | **TPE 2:** Creating and Maintaining Effective Environments for Student Learning | **TPE 3:** Understanding and Organizing Subject Matter for Student Learning |
| **TPE 4:** Planning Instruction and Designing Learning Experiences for All Students | **TPE 5:** Assessing Student Learning | **TPE 6:** Developing as a Professional Educator |

1. **Course Description:** EDUC X313S focuses on the examination of curriculum, pedagogy, and strategies that make science learning available to all students, how students develop deep understanding in science and how assessments help guide meaningful instructional practices. Learning is framed as goal-oriented expertise capable of empowering diverse students and K-12 classroom communities.

1. **Course Goal and Outcomes**

1. ***Course Goal:*** The primary course goal is to provide candidates the opportunity to develop a deep conceptual understanding and mastery of the Next Generation Science Standards (NGSS) and how to facilitate learning for all students.

This course facilitates collaboration among candidates to foster creativity and critical thinking that promote effective science instruction that benefits culturally, ethnically, and linguistically diverse learners.

1. ***Learning Outcomes:*** Course Student Learning Outcomes (CLOs) are linked with Teacher Performance Expectations (TPEs) outlined by the CTC and with Program Learning Outcomes (PLOs), which are informed by the Extension Education Programs Learning Outcomes (EPLOs).
2. ***English Language Learner (ELL), English Language Development (ELD) and/or Specifically Designed Academic Instruction for English (SDAIE) Course Component:*** CLOs 1, 2, 4, 5
3. ***Inclusive Instruction Course Component:*** CLOs 1, 2, 3, 4, 5, 6
4. ***Technology Course Component:*** CLOs 1, 2, 3, 4, 5

The Course Learning Outcomes (CLOs) support student development of the Program Learning Outcomes (PLOs). The connections between the CLOs are made explicit through the indication of which PLOs are connected to each CLO below.

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| **CLOs & Assessments** | **Grading** |
| **CLO 1:** Candidates will critically evaluate the science and engineering practices to engage and support all students in learning (TPE 1; PLOs 1, 2, 3, 5, 7).  **Assessment:** Class Participation (preparation, engagement, and reflection); TPE Discussion Blogs; Getting to Know Your Students; Content to Practice; Lesson Reflection and Application. | Description, Points, Weight:  see below |
| **CLO 2:** Candidates will use the science and engineering practices to create and maintain effective environments for diverse students and classrooms (TPE 2, PLOs 1, 2, 3, 4, 5, 7).  **Assessment:** Class Participation (preparation, engagement, and reflection); TPE Discussion Blogs; Getting to Know Your Students; Content to Practice; Lesson Reflection and Application. | Description, Points, Weight:  see below |
| **CLO 3:** Candidates will apply their understanding of the science and engineering practices to organize subject matter for student learning, inclusive of scientific literacy instruction (TPE 3; PLOs 3, 6, 7).  **Assessment:** Class Participation (preparation, engagement, and reflection); TPE Discussion Blogs; Getting to Know Your Students; Content to Practice; Lesson Reflection and Application. | Description, Points, Weight:  see below |
| **CLO 4:** Candidates will apply the science and engineering practices as they plan and design learning experiences for all students (TPE 4; PLOs 1, 2, 3, 4, 5, 6, 7).  **Assessment:** Class Participation (preparation, engagement, and reflection); TPE Discussion Blogs; Getting to Know Your Students; Content to Practice; Lesson Reflection and Application. | Description, Points, Weight:  see below |
| **CLO 5:** Candidates will consider the science and engineering practices as they assess student learning (TPE 5; PLOs 2, 3, 6, 7).  **Assessment:** Class Participation (preparation, engagement, and reflection); TPE Discussion Blogs; Getting to Know Your Students; Content to Practice; Lesson Reflection and Application. | Description, Points, Weight:  see below |
| **CLO 6:** Candidates will consider whether/how the science and engineering practices intersect with personal values and biases influencing instruction (TPE 6; PLOs 1, 4, 7).  **Assessment:** Class Participation (preparation, engagement, and reflection); TPE Discussion Blogs; Getting to Know Your Students; Content to Practice; Lesson Reflection and Application. | Description, Points, Weight:  see below |

| Description of Assessments | Points | **Weight** | Due Date |
| --- | --- | --- | --- |
| **Weekly Reflection (Weekly Assignment in Canvas)**  Under each week you will find the agenda for the class session. You will be assessed on preparation for and attendance in class (10), engagement with your colleagues (10), and thoughtful reflection of the content (10) each week.  **Preparation: Video 3, 2, 1** (Bullet points - 100 words max)  What are three ideas/concepts new to you?  What are two things you wonder about?  What is one strategy/idea that you will incorporate into your classroom?  *Come prepared for a 10 minute discussion at the beginning of class.* | 15 | 15% | Weekly |
| **TPE Discussion Blogs (Weekly Assignment in Canvas)**  This course includes weekly online discussion. Critical engagement with readings, videos and course topics is required. This assignment consists of weekly blog entries on assigned readings, videos, and course topics. Your blog (minimum 250 words) should consider the following:  *Thoughtful synthesis and analysis of the content (10). Include any titles or authors as appropriate.*  *Specific connection of the content to 3- 4 TPE subcomponents, such that you have interacted with all 45 by the end of the term (10). Please include/quote the TPE subcomponent text and number.*  *Specific application of the content to science teaching and learning (10).*  In addition, you must respond to the entries of at least two other students per week. Please address the student to whom you are responding by first name. | 15 | 15% | Weekly |
| **Getting to Know Your Class**  Provide contextual information about one class you are teaching within your school placement. Also include standards-related learning needs and goals, assessment data, language proficiency status, and cultural background for both short-term and long-term instructional planning purposes.  We will use components of the CalTPA rubrics, which will be shared in class. | 10 | 10% | Week 4 |
| **Assessment Design**  You will design a formal assessment as part of a series of lessons you will teach. This allows you to backward plan. Include a description of informal assessments that lead up to the formal assessment.  We will use components of the CalTPA rubrics, which will be shared in class. | 10 | 10% | Week 6 |
| **Content to Practice: Lesson Planning, Design and Implementation**  Using the BSCS 5E Instructional Model, you will plan, design and implement a 5-day science unit, making effective use of instructional time to maximize learning opportunities and provide access to the curriculum for all students by removing barriers and providing access through instructional strategies (see TPE 4.4).  This assessment affords the candidate the opportunity to practice for CalTPA Instructional Cycle 2.  Revisions for Week 9 should include evidence of differentiated instruction  We will use components of the CalTPA rubrics, which will be shared in class. | 25 | 25% | Week 8 – Discuss Lesson with Colleagues  Week 9 – Revisions  Week 10 – Implement |
| **Lesson Reflection and Application: Annotated Video Recording of Lesson, Written Reflections and Video or Written Application**  You will annotate your video with titles and brief rationales for your teaching practices.  You will provide a written narrative analyzing the informal assessments results for the whole class and for individual students.  You will provide a written narrative analyzing the formal assessment results for the whole class and choose three examples to elaborate further.  You will provide a written narrative reflecting on evidence of student learning and describe what you think you would need to do next for individual students and the whole class.  This assessment affords the candidate the opportunity to practice for CalTPA Instructional Cycle 2.  We will use components of the CalTPA rubrics, which will be shared in class. | 25 | 25% | Week 14 |

1. **Format and Procedures:** This synchronous, face-to-face class meets weekly for a semester. Some course content and all assessment submissions are handled through the Canvas learning management system.

1. **Course Requirements**
   1. ***Class Attendance and Participation Policy*** 
      1. Attendance: Attendance for all class sessions is required. A candidate is responsible for the content and experiences of any missed class sessions. Missing more than one class session for any reason constitutes excessive absences, which may be handled in the following way:
         1. Absences may impact a candidate’s final grade.
         2. The candidate may be granted an incomplete (in the case of illness or death in the family) and asked to retake a portion of, or the entire course in the following term.
         3. The candidate may be asked to re-enroll or retake the course.
      2. Anticipated Absences: The candidate is responsible for clearing anticipated absences with his/her professor of the class BEFORE committing to an event which conflicts with class (e.g., Back to School Night). This assures that a candidate has either developed a plan for receiving full benefit from the course or does not commit to the conflicting event.
      3. Late Work: In general, the policy regarding late work is that if work is late due to an excused absence (an absence cleared in advance), the work may be turned in up to one week late without penalty. All other late work is docked one letter grade and must be turned in within one week of its due date. Work turned in later than one week will receive no credit.
      4. Participation**:** Candidates are expected to participate fully in each class session, as each Teacher Preparation Program course is a combination of theory and praxis to facilitate development of the California Standards for the Teaching Profession (CSTP) as outlined in the Teaching Performance Expectations (TPEs), developed by the CTC.
      5. Tardiness: A candidate who is late to class is considered absent for that portion of the class. Habitual tardiness will accumulate to equal an absence of one or more class sessions (refer to section on Attendance above).
   2. ***Technology Policy***

Candidates are preparing to become professional educators. Candidates are expected to conduct themselves as professionals, fully engaging classroom learning as a matter of courtesy extended to colleagues. Smart phone and laptop technologies are for learning purposes only. These cannot be used during class for personal texting, email, or social media. Violators will receive a “F” grade for class participation.

* 1. ***Time Expenditure***

EDUC X313 is 3-unit course requiring a total of 135 hours (including class time) over the semester. The following is an estimated breakdown of time candidates can expect to spend in completing this course:

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| Class Sessions | 45 hours |
| Class Preparation and Reflection | 15 hours |
| TPE Discussion Blogs | 25 hours |
| Getting to Know Your Class | 5 hours |
| Assessment Design | 5 hours |
| Content to Practice | 20 hours |
| Lesson Reflection and Application | 20 hours |
| **Total** | **135 hours** |

1. **Grading Procedures:** All UC Merced Extension Teacher Preparation Program courses are graded. The course grade will be calculated as follows:

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| --- | --- |
|  | % |
| Class Preparation and Reflection | 15 |
| TPE Discussion Blogs | 15 |
| Getting to Know Your Class | 10 |
| Assessment Design | 10 |
| Content to Practice | 25 |
| Lesson Reflection and Application | 25 |
| **Total** | **100%** |

Candidates must achieve a B course grade for credit in the UC Merced Extension Teacher Preparation Program. A course grade lower than B is not acceptable for credit in the Teacher Preparation Program. Letter grades will be assigned as follows:

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| **Letter Grade** | **Percentage** | **Grade Point Equivalent** | **Graduate Level Grades** |
| A | 93-100% | 4.0 | Excellent |
| A- | 90-92% | 3.7 | Outstanding |
| B+ | 87-89% | 3.3 | Above Average |
| B | 83-86% | 3.0 | Average |
| B- | 80-82% | 2.7 | Satisfactory |
| C+ | 77-79% | 2.3 | Marginal, but not acceptable for credit in the Teacher Preparation Program |
| C | 73-76% | 2.0 |
| C- | 70-72% | 1.7 |
| D | 60-69% |  | Not acceptable |
| F | 0-59% |  | Not acceptable |

1. **Academic Integrity:** Each candidate in this course is expected to abide by the University of California, Merced Academic Honesty Policy. Any work submitted by a candidate in this course for academic credit will be the candidate's own work. Candidates are encouraged to study together and to discuss information and concepts covered in the course with other students. Candidates can give "consulting" help to or receive "consulting" help from each other. However, this cooperation should never involve one student taking credit for work done by someone else. Violation of UC Merced Academic Honesty Policy will result in an automatic “F” for the assignment. At instructor discretion, the policy may be extended to include failure of the course and/or University disciplinary action.
2. **Accommodations for Students with Disabilities:** The University of California, Merced is committed to ensuring equal academic opportunities and inclusion for candidates with disabilities based on the principles of independent living, accessible universal design and diversity. The instructor is available to discuss appropriate academic accommodations that may be required for a candidate with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester (or equivalent), except for unusual circumstances. Candidates are encouraged to register with the Disability Services Center to verify their eligibility for appropriate accommodations.
3. **Tentative Weekly Schedule**

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| **Week** | **Topic** | **Due** |
| 1 | *Welcome!*  *Syllabus*  *Review of Required Textbooks and Class Format*  *Next Generation Science Standards (NGSS) Overview* | **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 2-24  **Video for Week 1** |
| 2 | *Physical Sciences*  Activity 6, p. A-27 | **Reflection of Week 1**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 25-47  **Video for Week 2** |
| 3 | *Earth and Space Sciences*  Activity – Project WET: The Blue Planet and The Incredible Journey  Discuss Assignment – G**etting to Know Your Class** | **Reflection of Week 2**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 48-66  **Video for Week 2** |
| 4 | *Life Sciences*  Activity 43, p. A-139  Share what you learned – **Getting to Know Your Class**  Discuss **Assessment Design** | **Reflection of Week 3**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 67-82  **CalTPA: Getting to Know Your Class**  **Video for Week 4** |
| 5 | *Physical Sciences*  Activity – Student Choice  Each Teacher Candidate will facilitate an activity during the course for your colleagues. | **Reflection of Week 4**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 141-177  **Video for Week 5** |

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| 6 | *Earth and Space Sciences*  Activity – Student Choice  Each Teacher Candidate will facilitate an activity during the course for your colleagues.  Discuss Assignment – C**ontent to Practice: Lesson Planning, Design and Implementation** | **Reflection of Week 5**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 83-110  **CalTPA: Assessment Design**  **Video for Week 6** |
| 7 | *Life Sciences*  Activity – Student Choice  Each Teacher Candidate will facilitate an activity during the course for your colleagues. | **Reflection of Week 6**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 111-140  **Video for Week 7** |
| 8 | Collaborate with Colleagues – **Content to Practice: Lesson Planning, Design and Implementation** | **Reflection of Week 7**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 212-244  **CalTPA: Content to Practice: Lesson Planning, Design and Implementation**  Be prepared to collaborate with colleagues |
| 9 | *Physical Sciences*  Activity – Student Choice  Each Teacher Candidate will facilitate an activity during the course for your colleagues.  Discuss Implementation and Video recording – **Content to Practice: Lesson Planning, Design and Implementation** | **Reflection of Week 8**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 178-193  **CalTPA: Content to Practice: Lesson Planning, Design and Implementation**  Revisions  **Video for Week 9** |
| 10 | *Earth and Space Sciences*  Activity – Project WET, TBD | **Reflection of Week 9**  **CalTPA: Content to Practice: Lesson Planning, Design and Implementation**  Implement in the classroom and video record  **Video for Week 10** |

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| 11 | Debrief Unit Implementation  Discuss – **Lesson Reflection and Application: Annotated Video Recording of Lesson, Written Reflections and Video or Written Application** | **Reflection of Week 10**  **TPE Discussion Blog** on: *Teaching Science through Inquiry-Based Instruction*, pp. 194-211  **Video for Week 11** |
| 12 | *Argument-Driven Inquiry in Biology*  Lab Investigation | **Reflection of Week 11**  **TPE Discussion Blog** on: *Argument-Driven Inquiry in Biology,* TBD  **Video for Week 12** |
| 13 | *Argument-Driven Inquiry in Chemistry*  Lab Investigation | **Reflection of Week 12**  **TPE Discussion Blog** on: *Argument-Driven Inquiry in Chemistry,* TBD  **Video for Week 13** |
| 14 | Presentations – **Lesson Reflection and Application: Annotated Video Recording of Lesson, Written Reflections and Video or Written Application** | **Reflection of Week 13**  **CalTPA: Lesson Reflection and Application: Annotated Video Recording of Lesson, Written Reflections and Video or Written Application** |
| 15 | Presentations – **Lesson Reflection and Application: Annotated Video Recording of Lesson, Written Reflections and Video or Written Application** | **Reflection of Week 14** |

**Required Texts**

Contant, T.L., Tweed, A.L., Bass, J.E., & Carin, A.A. (2018). *Teaching science through inquiry-based instruction (13th edition).* New York, NY: Pearson.

**Required Resources (free online)**

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). *The BSCS 5E instructional model: Origins and effectiveness*. Colorado Springs, Co: BSCS, 5, 88-98.\*

The Next Generation Science Standards (NGSS) – California <https://www.nextgenscience.org/california>

**Selected Readings (provided in Canvas)**

Mastropieri, M. A., & Scruggs, T. E. (2017). *The inclusive classroom: Strategies for effective differentiated*

*instruction.* New York, NY: Pearson. 🡪 Chapter 15: Science, Social Studies and Transitions\*

Project WET (Water Education for Teachers, 2014). *Project WET curriculum and activity guide, generation 2.0*. Bozeman, MT: Project WET Foundation.

Sampson, V., Carafano, P., Enderle, P., Fannin, S. Grooms, J., Southerland, S.A., Stallworth, C. & Williams, K. (2014). *Argument-Driven inquiry in chemistry: Lab investigations for grades 9-12.* Arlington, VA: NSTA Press.

Sampson, V., Enderle, P., Gleim, L., Grooms, J., Hester, M., Southerland, S. & Wilson, K. (2014). *Argument-Driven inquiry in biology: Lab investigations for grades 9-12*. Arlington, VA: NSTA Press.

\*This resource/text is used in multiple courses.