Continuing Education
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SCI-929: Virtual Science Labs

Independent Study Online Course Syllabus

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Course Description

Laboratory exercises are a wonderful way to explore and experience science. Using a project based approach, students will learn about and experience the use of virtual science labs suitable for use in their classroom. Each project is directly tied to specific National Educational Technology Standards. The course will provide participants with a survey of what types of virtual science labs are possible. Then, using computer and Internet technology, students will develop meaningful lessons centered around virtual science labs that also meet subject matter standards and framework requirements. Finally, participants will create a simple virtual science lab of their own design.

Note: There is no required book for this course.

Required Texts and Course Materials

Digital Camera: A digital camera will be useful to complete the assignments (most cellphones have this feature).

Canvas: This course will be delivered totally online. Canvas is a web-based learning management system (LMS) that provides students access to online resources, documents, videos, assignments, quizzes, forums, etc. Canvas is easy to learn and has a user-friendly interface.

Online Resources: Relevant online resources that support the course content and encourage further investigation will be available throughout the course assignments. Active hyperlinks are utilized throughout the course and will link to the appropriate information when clicked. These include videos, podcasts, worksheets, online activities, journal articles and other resources.

Course Dates

Self-paced; students may enroll at any time and take up to one year, from the date of registration to complete assignments. Students may complete assignments in no less than three weeks for a 3-unit course (one week per unit).

National Standards Addressed in This Course

National Board for Professional Teaching Standards (NBPTS)
(http://www.nbpts.org/standards-five-core-propositions/)

First published in 1989 and updated in 2016, *What Teachers Should Know and Be Able to Do* articulates the National Board's Five Core Propositions for teaching. The Five Core Propositions - comparable to medicine's Hippocratic Oath — set forth the profession's vision for accomplished teaching. Together, the propositions form the basis of all National Board Standards and the foundation for National Board Certification. Course assignments have been designed so students can demonstrate excellence against these professional teaching standards whenever possible.

- Proposition 1: Teachers are committed to students and their learning
- Proposition 2: Teachers know the subject they teach and how to teach those subjects to students
- Proposition 3: Teachers are responsible for managing and monitoring student learning
- Proposition 4: Teachers think systematically about their practice and learn from experience
- Proposition 5: Teachers are members of learning communities

ISTE National Educational Technology Standards (NETS) (https://www.iste.org/standards/for-educators)

The projects contained in this course for teachers are closely aligned to the ISTE National Educational Technology Standards (NETS). Numbers in parentheses following each learning outcome above refer to the National Educational Technology Standards category to which the outcome is linked. The categories are:

1. Learner
2. Leader.
3. Communicator
4. Collaborator
5. Designer
6. Facilitator
7. Analyst

Several of the course projects ask participants to identify specific national, state or district standards for their curriculum that will be applied to the lessons presented.

National Research Council (NRC) Framework for K-12 Science Education
(https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscuttingconcepts)

The Virtual Science Labs activities relate to the practices endorsed by the National Research Council. National Research Council's Framework for K-12 Science Education identifies 8 practices of science and engineering that are essential for all students to learn. These are:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Continuing Education Student Learning Outcomes (CE-SLO)

CE-SLO 1	Demonstrate proficient written communication by articulating a clear focus, synthesizing arguments, and utilizing standard formats in order to inform and persuade others, and present information applicable to targeted use.
CE-SLO 2	Demonstrate comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
CE-SLO 3	Reflect on their personal and professional growth and provide evidence of how such reflection is utilized to manage personal and professional improvement.
CE-SLO 4	Apply critical thinking competencies by generating probing questions, recognizing underlying assumptions, interpreting and evaluating relevant information, and applying their understandings to the professional setting.
CE-SLO 5	Reflect on values that inspire high standards of professional and ethical behavior as they pursue excellence in applying new learning to their chosen field.
CE-SLO 6	Identify information needed in order to fully understand a topic or task, organize that information, identify the best sources of information for a given enquiry, locate and critically evaluate sources, and accurately and effectively share that information.

Course Student Learning Outcomes (C-SLO)

Student Learning Outcomes for This Course By the end of this course, the students will be able to:	**National Standards Addressed***	**CE-SLO Addressed****
1. Demonstrate an understanding of the history and current use of virtual reality experiences in education.	NETS 1, 2, 6 NRC 8 NBPTS 2, 4	CE 2, 3, 5
2. Recognize and describe the different types virtual science labs that are suitable for educational purposes.	NETS I, 7 NRC 1, 3, 7 NBPTS 1, 2	CE 2, 6
3. Create a resource of potential virtual science labs for classroom use.	NETS 2, 5 NRC 1, 3 NBPTS 1, 3	CE 2, 6
4. Describe the components of a virtual science lab.	NETS 1, 5, 7 NRC 6 NBPTS 2	CE 1, 2, 6
5. Create lesson plans centered around a virtual science lab that meets specific subject matter standards and/or frameworks	NETS 2, 3 NRC 2 NBPTS 1, 2, 3	CE 4, 5
6. Develop a virtual science lab and have it posted on Moodle.	NETS 4, 5 NRC 2, 3 NBPTS 5	CE 1, 2, 4

7. Identify, evaluate, and use resources for further study in the area of virtual science labs	NETS 1, 3, 7 NRC 1, 4 NBPTS 2, 4	CE 2, 4, 6
8. Use the Internet in ways that make teaching and learning more efficient, exciting, and educational.	NETS 2, 5 NRC 8 NBPTS 1, 2	CE 3, 4, 5
9. Identify, select, and use hardware and software technology resources specially designed for use by K-12 students to meet specific teaching and learning objectives.	NETS 2, 6, 7 NRC 2, 3 NBPTS 2, 3	CE 2, 4
10. Plan and teach student-centered learning activities and lessons in which students apply technology tools and resources.	NETS 2, 5, 6, 7 NRC 8 NBPTS 1	CE 2, 4, 6
11. Guide collaborative learning activities in which students use technology resources to solve problems in the subject area(s).	NETS 2, 4, 6 NRC 2 NBPTS 3	CE 2

* Please refer to the section on **National Standards Addressed in This Course**
** Please refer to the section on **Continuing Education Program Student Learning Outcomes**

Topics, Assignments, and Activities

Module Title	Module Assignments and Activities	Points Possible
Home Page	• Welcome Video • Course Syllabus • Policies and Procedures • Introduce Yourself Forum	
Module 1 – Welcome, Introduction, Background	• Reflection/Goals Activity • Pedagogical Value Paper • Get Acquainted Discussion Forum • Video Instruction • Internet Articles	20 pts 100 pts 20 pts
Module 2 – Virtual Science Demonstration Labs	• 10 Lab Write-Ups • Demonstration Lab Lesson Plan • Forum • Video Instruction • Internet Articles	100 pts 50 pts 20 pts
Module 3 – Virtual Science Simulation/Animation Labs	• 10 Lab Write-Ups • Simulation Lab Lesson Plan • Forum • Video Instruction • Internet Articles	100 pts 50 pts 20 pts
Module 4 – Virtual Science Interactive Labs	• 10 Lab Write-Ups • 10 Commercial Lab Descriptions • Interactive Lab Lesson Plan • Forum • Video Instruction • Internet Articles	100 pts 50 pts 50 pts 20 pts

Module 5 – Creating a Virtual Science Lab	• Virtual Science Lab Creation • Virtual Science Lab Lesson Plan • Forum • Video Instruction • Internet Articles	150 pts 50 pts 20 pts
Course Wrap-up – Grading and Evaluation	• Final Reflection Forum • Course Evaluation • Course Completion Checklist • Grade Request / Transcript Request	
	TOTAL POINTS	**920 points**

Grading Policies, Rubrics, and Requirements for Assignments

Grading Policies

- Assignments will be graded per criteria presented in the course rubrics.
- A = 90-100% and B = 80-89%, (anything below 80% will not receive credit.)
- The discernment between an A or a B letter grade is at the discretion of the instructor based on the quality of work submitted (see course rubrics).
- Coursework falling below a B grade will be returned with further instructions.
- All assignments must be completed to receive a grade and are expected to reflect the quality that teacher-training institutions require of professional educators. If completed assignments do not meet this standard, students will be notified with further instructions from the instructor.

Grading Rubrics

Grade	Percent	Description	Rubric
A	90-100%	Excellent	Meets all course / assignment requirements with significant evidence of subject mastery and demonstration of excellent graduate level professional development scholarship.
B	80-89%	Very Good	Adequately meets criteria for all course/assignment requirements - demonstrates subject competency with very good graduate level professional development scholarship.
NC	Below 80%	Unacceptable	Does not meet the minimum criteria for all course/assignment requirements and demonstrated little, if any, evidence of acceptable graduate level professional development scholarship.

Writing Requirements

- **Superior:** Writing is clear, succinct, and reflects graduate level expectations. Clearly addresses all parts of the writing task. Maintains a consistent point of view and organizational structure. Includes relevant facts, details, and explanations.
- **Standard:** Writing is acceptable with very few mistakes in grammar and spelling. Addresses most parts of the writing task. Maintains a mostly consistent point of view and organizational structure. Includes mostly relevant facts, details, and explanations.
- **Sub-standard:** Writing contains noticeable mistakes in grammar and spelling. Does not address all parts of the writing task. Lacks a consistent point of view and organizational structure. May include marginally relevant facts, details, and explanations.

Lesson Plan Requirements

- **Superior:** Instructional goals and objectives clearly stated. Instructional strategies appropriate for learning outcome(s). Method for assessing student learning and evaluating instruction is clearly delineated and authentic. All materials necessary for student and teacher to complete lesson clearly listed.
- **Standard:** Instructional goals and objectives are stated but are not easy to understand. Some instructional strategies are appropriate for learning outcome(s). Method for assessing student learning and evaluating instruction is present. Most materials necessary for student and teacher to complete lesson are listed.
- **Sub-standard:** Instructional goals and objectives are not stated. Learners cannot tell what is expected of them. Instructional strategies are missing or strategies used are inappropriate. Method for assessing student learning and evaluating instruction is missing. Materials necessary for student and teacher to complete lesson are missing.

Instructor/Student Contact Information

Throughout the course participants will be communicating with the instructor and their classmates on a regular basis using asynchronous discussion forums. Students are provided with instructor contact information in the event they want to make email or phone contact. In addition, students are encouraged to email or phone the instructor at any time. Students will also receive feedback on the required assignments as they are submitted.

Forums

Participation is an important expectation of this course and all online courses. Online discussions promote reflection and analysis while allowing students to appreciate and evaluate positions that others express. While students may not be engaging with the same students throughout this course, they will be expected to offer comments, questions, and replies to the discussion question whenever possible. The faculty role in the discussion forum is that of an observer and facilitator.

Coursework Hours

Based on the Carnegie Unit standard, a unit of graduate credit measures academic credit based on the number of hours the student is engaged in learning. This includes all time spent on the course: reading the textbook, watching videos, listening to audio lessons, researching topics, writing papers, creating projects, developing lesson plans, posting to discussion boards, etc. Coursework offered for FPU Continuing Education graduate credit adheres to 45 hours per semester unit for the 900-level courses. Therefore, a student will spend approximately 135 hours on a typical 3-unit course.

Services for Students with Disabilities

Students with disabilities are eligible for reasonable accommodations in their academic work in all classes. In order to receive assistance, the student with a disability must provide the Academic Support Center with documentation, which describes the specific disability. The documentation must be from a qualified professional in the area of the disability (i.e. psychologist, physician or educational diagnostician). Once documentation is on file, arrangements for reasonable accommodations can be made. For more information and for downloadable forms, please go to https://www.fresno.edu/departments/disability-access-education.

Plagiarism and Academic Honesty

All people participating in the educational process at Fresno Pacific University are expected to pursue honesty and integrity in all aspects of their academic work. Academic dishonesty, including plagiarism, will be handled per the procedures set forth in the Fresno Pacific University Catalogue and Handbook - https://handbook.fresno.edu/graduate/academic-policies

Technology Requirements

To successfully complete the course requirements, course participants will need Internet access, can send and receive email, know how to manage simple files in a word processing program, and have a basic understanding of the Internet. Please remember that the instructor is not able to offer technical support. If you need technical support, please contact your Internet Service Provider.

Getting Help with Canvas: If you need help with Canvas, please contact the FPU Help Desk by phone: (559) 453-3410 or email: helpdesk@fresno.edu. Help is available Mon-Fri 8:00 am to 7:00 pm.

Final Course Grade and Transcripts

When all work for the course has been completed, students will need to logon to the Continuing Education website (https://ce.fresno.edu/my-account) and "Request Final Grade". Once the instructor receives the requests and submits the grade online, students may log back in to view their Final Grade Report or order transcripts online. Please allow at least two weeks for the final grade to be posted. For more information, see the Continuing Education Policies and Procedures at https://ce.fresno.edu/ce-policies-and-procedures.

University Policies and Procedures

Students are responsible for becoming familiar with the information presented in the Academic Catalog and for knowing and observing all policies and procedures related to their participation in the university community. A summary of university policies may be found on the university website at https://www.fresno.edu/departments/registrars-office/academic-catalogs.

Fresno Pacific University Student Learning Outcomes (FPU-SLO)

FPU-SLO 1	**Oral Communication:** Students will *exhibit* clear, engaging, and confident oral communication – in both individual and group settings – and will critically *evaluate* content and delivery components.
FPU-SLO 2	**Written Communication:** Students will *demonstrate* proficient written communication by *articulating* a clear focus, *synthesizing* arguments, and utilizing standard formats in order to *inform* and *persuade* others.
FPU-SLO 3	**Content Knowledge:** Students will *demonstrate* comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
FPU-SLO 4	**Reflection**: Students will *reflect* on their personal and professional growth and *provide evidence* of how such reflection is utilized to manage personal and vocational improvement.

FPU-SLO 5	**Critical Thinking:** Students will *apply* critical thinking competencies by *generating* probing questions, *recognizing* underlying assumptions, *interpreting* and *evaluating* relevant information, and *applying* their understandings to new situations.
FPU-SLO 6	**Moral Reasoning:** Students will *identify* and *apply* moral reasoning and ethical decision-making skills, and *articulate* the norms and principles underlying a Christian worldview.
FPU-SLO 7	**Service**: Students will *demonstrate* service and reconciliation as a way of leadership.
FPU-SLO 8	**Cultural and Global Perspective:** Students will *identify* personal, cultural, and global perspectives and will employ these perspectives to *evaluate* complex systems.
FPU-SLO 9	**Quantitative Reasoning**: Students will accurately *compute* calculations and symbolic operations and *explain* their use in a field of study.
FPU-SLO 10	**Information Literacy:** Students will *identify* information needed in order to fully understand a topic or task, *explain* how that information is organized, *identify* the best sources of information for a given enquiry, *locate* and critically *evaluate* sources, and accurately and effectively *share* that information.