Center for Professional Development
1717 S. Chestnut Ave.
Fresno, CA 93702-4709
(800) 372-5505
http://ce.fresno.edu

STEM 902 – Makerspace: Technology and Tinkering

Independent Study Online Course Syllabus

Instructor: Paul Reimer **Phone number:** 559-916-1314 **Email:** paulreimer@me.com **Other Contact Information:** reimermath.com	**Number of Graduate Semester Units:** 3 **Target Grade Level:** K – 12th **Course Access:** http://ce-connect.fresno.edu

Course Description

The maker revolution has opened the door for educators to bring exciting engineering and design opportunities into the classroom. Invention, tinkering, and design can deeply engage learners in creative collaboration, the development of shared knowledge, and problem solving processes. Tinkering is an iterative process in which students question, explore, experiment, and evaluate their progress toward a specific goal. Maker-oriented classrooms also provide students with opportunities to develop the thinking dispositions necessary for innovating and creating across the domains.

This online course will introduce teachers to the maker movement, its history, and key applications for today's classroom. Participants will learn how to develop makerspace within their classrooms and will explore specific pedagogies for maker-centered learning. All of the readings and activities included in this course support the Common Core Mathematics Content and Practice Standards, the Next Generation Science Standards (NGSS), and the ISTE Standards for Computer Science Educators.

Online Resources: Relevant online resources that support the course content and encourage further investigation will be available throughout the course assignments. Several research-based journal articles are used with permission and available in pdf format in the course management system.

Moodle: Moodle is a web-based course management system used to support flexible teaching and learning in both face-to-face and distance courses (e-learning). www.moodle.org, www.demo.moodle.org, www.docs.moodle.org

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 (one week per credit), to complete the course.

National Standards Addressed in This Course

Common Core Standards for Mathematics
http://www.corestandards.org/the-standards/mathematics
Counting & Cardinality
Operations & Algebraic Thinking
Number & Operations in Base Ten
Number & Operations—Fractions
Measurement & Data
Geometry
Ratios & Proportional Relationships
The Number System
Expressions & Equations
Functions
Statistics & Probability

Common Core Standards for Mathematical Practice
http://www.corestandards.org/Math/Practice/
Standard 1: Make sense of problems and persevere in solving them
Standard 2: Reason abstractly and quantitatively
Standard 3: Construct viable arguments and critique the reasoning of others
Standard 4: Model with mathematics
Standard 5: Use appropriate tools strategically
Standard 6: Attend to precision
Standard 7: Look for and make use of structure
Standard 8: Look for and express regularity in repeated reasoning

ISTE Standards:
http://www.iste.org/standards/ISTE-standards/standards-for-teachers

Next Generation Science Standards:
http://www.nextgenscience.org/next-generation-science-standardS

Common Core Standards for English Language Arts
http://www.corestandards.org/ELA-Literacy/
Anchor Standards
Reading: Literature
Reading: Informational Text
Reading: Foundational Skills
Writing
Speaking & Listening

Language
Range, Quality, & Complexity
Literacy in Science & Technical Subjects

National Board for Professional Teaching Standards
http://www.nbpts.org/five-core-propositions
Proposition 1: Teachers are committed to students and their learning.
Proposition 2: Teachers know the subjects 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.

Continuing Education Program Student Learning Outcomes

CE 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 2	Demonstrate comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
CE 3	Reflect on their personal and professional growth and provide evidence of how such reflection is utilized to manage personal and professional improvement.
CE 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 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 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.

Student Learning Outcomes (SLOs) for This Course

Student Learning Outcomes in This Course By the end of this course student will be able to:	**National Standards Addressed in This Course***	**Continuing Education Program Student Learning Outcomes Addressed****
1. Demonstrate through written reflection a thorough understanding of the Makerspace and tinkering movements and how they relate to current Common Core, ISTE, and STEM principles and standards.	NBPTS Prop. 1, 2	CE 1, CE 2, CE 4, CE 6
2. Demonstrate effective use of tools, resources, and pedagogies that support implementation of makerspace and tinkering in the classroom.	NBPTS Prop. 2, 4	CE 2, CE 4, CE 6
3. Analyze, design, facilitate, and reflect on Makerspace and tinkering lessons.	NBPTS Prop. 2, 3, 4, 5	CE 2, CE 3, CE 4, CE 6
4. Collaborate with teaching peers and online colleagues to share insights and deepen their professional practice.	NBPTS Prop. 1,2,4, 5	CE 1, CE 3, CE 4, CE 5, CE 6

* 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 Topics	**Module Assignments and Activities**	**Points Possible for Each Assignment**	**Estimated Time to Complete Assignment**
Welcome and General Information Module			5
Module 1 – Orientation and Introductions	**Module 1 -** Introductions and goals for class.	8	5

Module Topics	Module Assignments and Activities	Points Possible for Each Assignment	Estimated Time to Complete Assignment
Module 2 – Joining a Maker Revolution	**Module 2 -** Reflect on the Maker Movement and its implications for 21st century classrooms. Watch videos, read topic articles, and participate in forum discussions.	4	15
Module 3– Research and Rationale	**Module 3 -** Research the rationale for setting up a Makerspace and tinkering classroom. Explore connections to relevant standards and STEM learning. Read articles provided in this topic and participate in forum discussions.	4	15
Module 4 – Makerspace Standards	**Module 4 -** Explore essentials of developing a Makerspace classroom culture. Read articles and participate in forum postings and discussions.	8	15
Module 5 – Designing Your Makerspace	**Module 5 -** Planning and setting up your Makerspace	4	15
Module 6 – Developing a Tinkering Toolkit	**Module 6 -** Explore and evaluate online tools and resources. Select and review a resource. Engage in peer research critique and discussion.	8	15
Module 7 – Peer Tips and Techniques	**Module 7 -** Examine notable Makerspaces; analyze peer implementation. Reflect on vignettes and analyze approaches.	8	15
Module 8 – Project Design and Implementation	**Module 8 -** Design projects relevant for your grade level. Conduct projects with your class and reflect. Participate in peer project review.	30	30
Module 9 – Final Reflection	**Module 9 -** Develop a checklist, create presentation, reflective conversation with colleague	10	5

Grading Policies and Rubrics for Assignments

- Assignments will be graded per criteria presented in the course grading rubrics.
- Students must earn a minimum of 80% to received credit for the assignment.
- A = 90-100% and B= 80-89%, (anything below 80% will not receive credit.)
- Grading Policies:
  - The discernment between an A or a B is at the discretion of the instructor based on the quality of work submitted (see assignment rubrics).
  - Coursework falling short of a quality equaling a B or a Credit Grade will be returned with further instructions.
  - All assignments must be completed to receive a grade. In addition, all assignments 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.

Assignment Rubric:

Written assignments and papers need to follow APA formatting. Details regarding quality of assignment expectations are provided in the assignment rubric found in the course management system.

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 - https://www.fresno.edu/students/registrars-office/academic-catalogs

Discussion 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.

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.

Moodle:
This course will be delivered totally online. Moodle is a learning management system that provides students access to online resources, documents, graded assignments, quizzes, discussion forums, etc. with an easy to learn and use interface. To learn more about Moodle, go to: (https://docs.moodle.org/30/en/Student_FAQ). There are some student tutorials on the Center for Online Learning website at Fresno Pacific University – http://col.fresno.edu/student.

Moodle Site Login and Passwords – (or other online course access information):
Students will need to have internet access to log onto http://ce-connect.fresno.edu. The username and password numbers for Moodle access will be sent to you by the university using the email address you submitted at the time of registration. The instructor will then contact you with a welcome letter and login instructions. If you need help with the username and password recovery, please contact the Center for Professional Development at (800) 372-5505 or (559) 453-2000 during regular office hours - Mon-Fri 8:00 am to 5:00 pm. or email prof.dev@fresno.edu

Getting Help with Moodle:
If you need help with Moodle, please contact the Center for Online Learning (COL), by telephone or the website. Help by phone (559-453-3460) is available Mon-Thurs 8:00 am to 8:00 pm and on Fridays from 8:00 am to 5:00 pm, or by filling out a "Request Services" form at http://col.fresno.edu/contact/request-services. Please identify that you are with the "School = Continuing Education".

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. A virtual office is utilized for class questions and students are provided with instructor contact information in the event they want to make phone or email 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.

Final Course Grade and Transcripts

When all work for the course has been completed, students will need to logon to the Center for Professional Development website (http://ce.fresno.edu/cpd) to "Submit Grade Form". Once the instructor fills out the grade form online, students may log back in to request their Grade Report as well as order transcripts online. Please allow at least two weeks for the final grade to be posted. For more information, see the Independent Studies Policies and Procedures at http://ce.fresno.edu/cpd/policies/

References

Additional resources will be included in the course management system.

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 http://registrar.fpu.edu/catalog.

Fresno Pacific University Student Learning Outcomes

Student Learning Outcomes 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.
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.
Content Knowledge: Students will *demonstrate* comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
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.
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.
Moral Reasoning: Students will *identify* and *apply* moral reasoning and ethical decision-making skills, and *articulate* the norms and principles underlying a Christian world-view.
Service: Students will *demonstrate* service and reconciliation as a way of leadership.
Cultural and Global Perspective: Students will *identify* personal, cultural, and global perspectives and will employ these perspectives to *evaluate* complex systems.
Quantitative Reasoning: Students will accurately *compute* calculations and symbolic operations and *explain* their use in a field of study.
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.