Continuing Education
1717 S. Chestnut Ave.
Fresno, CA 93702-4709
(800) 372-5505
http://ce.fresno.edu

STEM-909 – 3D Printing for Teachers

Independent Study Online Course Syllabus

Instructor: Eric Westland, M. Ed
Phone: (435) 625-1399
Email: eric.westland@fresno.edu
Website: westland.dscloud.me/wordpress/

Number of Graduate Semester Units: 3
Target Audience: Any Educator
Course Access: https://connect.fresno.edu
YouTube Channel: MrWestland

Course Description

The Good News: Your school district purchased a 3D printer for your classroom. The Bad News: Training wasn't included.

Unlock the educational potential of 3D printing with this comprehensive online course tailored for teachers. Designed for all skill levels, this course will guide you through the essentials of 3D printing technology, from understanding the hardware and software to exploring practical classroom applications.

You'll learn to create 3D designs using user-friendly software and develop engaging lesson plans that align with STEM standards. Through interactive modules, video tutorials, and virtual hands-on projects, you'll gain the confidence to implement 3D printing in your teaching. By the end of the course, you'll be ready to inspire your students with innovative projects that foster creativity, critical thinking, and problem-solving skills.
Note: Required book must be acquired separately.

Recommended Texts and Course Materials

Book: Torta, S., & Torta, J, (2018). 3D Printing: An Introduction. Mercury Learning and Information. ISBN-13: 978-1683922094. https://www.amazon.com/3D-Printing-Introduction-Stephanie-Torta/dp/1683922093

Note: Students are responsible for purchasing their own textbook, analyzing the content, and applying what they learned to the course assignments. You are welcome to purchase used, ebook, or new versions to save money. You can order the book directly from the publisher or from one of several discount aggregators (for example): http://books.nettop20.com

Hardware: This class can be completed without access to a 3D printer and we'll explore methods to help you teach 3D printing to your students the same way.

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.

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.

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

National Board for Professional Teaching Standards (NBPTS)

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

McRel Technology Standards

1. Knows the characteristics and uses of computer hardware and operating systems
2. Knows the characteristics and uses of computer software programs
3. Understands the relationships among science, technology, society, and the individual
4. Understands the nature of technological design
5. Understands the nature and operation of systems.
6. Understands the nature and uses of different forms of technology

ISTE Standards for Educators

1. Learner

   Educators continually improve their practice by learning from and with others and exploring proven and promising practices that leverage technology to improve student learning. Educators:

   a. Set professional learning goals to explore and apply pedagogical approaches made possible by technology and reflect on their effectiveness.
   b. Pursue professional interests by creating and actively participating in local and global learning networks.
   c. Stay current with research that supports improved student learning outcomes, including findings from the learning sciences.

2. Leader

   Educators seek out opportunities for leadership to support student empowerment and success and to improve teaching and learning. Educators:

   a. Shape, advance and accelerate a shared vision for empowered learning with technology by engaging with education stakeholders.
   b. Advocate for equitable access to educational technology, digital content and learning opportunities to meet the diverse needs of all students.
   c. Model for colleagues the identification, exploration, evaluation, curation and adoption of new digital resources and tools for learning.

3. Citizen

Educators inspire students to positively contribute to and responsibly participate in the digital world. Educators:

a. Create experiences for learners to make positive, socially responsible contributions and exhibit empathetic behavior online that build relationships and community.
b. Establish a learning culture that promotes curiosity and critical examination of online resources and fosters digital literacy and media fluency.
c. Mentor students in the safe, legal and ethical practices with digital tools and the protection of intellectual rights and property.
d. Model and promote management of personal data and digital identity and protect student data privacy.

4. Collaborator

Educators dedicate time to collaborate with both colleagues and students to improve practice, discover and share resources and ideas, and solve problems. Educators:

a. Dedicate planning time to collaborate with colleagues to create authentic learning experiences that leverage technology.
b. Collaborate and co-learn with students to discover and use new digital resources and diagnose and troubleshoot technology issues.
c. Use collaborative tools to expand students' authentic, real-world learning experiences by engaging virtually with experts, teams and students, locally and globally.
d. Demonstrate cultural competency when communicating with students, parents and colleagues and interact with them as co-collaborators in student learning.

5. Designer

Educators design authentic, learner-driven activities and environments that recognize and accommodate learner variability. Educators:

a. Use technology to create, adapt and personalize learning experiences that foster independent learning and accommodate learner differences and needs.
b. Design authentic learning activities that align with content area standards and use digital tools and resources to maximize active, deep learning.
c. Explore and apply instructional design principles to create innovative digital learning environments that engage and support learning.

6. Facilitator

Educators facilitate learning with technology to support student achievement of the 2016 ISTE Standards for Students. Educators:

a. Foster a culture where students take ownership of their learning goals and outcomes in both independent and group settings.
b. Manage the use of technology and student learning strategies in digital platforms, virtual environments, hands-on makerspaces or in the field.
c. Create learning opportunities that challenge students to use a design process and computational thinking to innovate and solve problems.
d. Model and nurture creativity and creative expression to communicate ideas, knowledge or connections.

7. Analyst

Educators understand and use data to drive their instruction and support students in achieving their learning goals. Educators:

a. Provide alternative ways for students to demonstrate competency and reflect on their learning using technology.
b. Use technology to design and implement a variety of formative and summative assessments that accommodate learner needs, provide timely feedback to students and inform instruction.
c. Use assessment data to guide progress and communicate with students, parents and education

stakeholders to build student self-direction.

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 for 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. Identify and differentiate between different hardware and software utilized in creating 3D-printed models.	(NBPTS 2) (ISTE-T 1,2,4,6) (McRel Tech 1, 2, 6)	CE 2, 6
2. Create, modify and locate digital models for integration in their instruction.	(NBPTS 2) (ISTE-T 4,5,6) (McRel Tech 4,6)	CE 4, 6
3. Evaluate and select the appropriate hardware and print media for their instruction.	(NBPTS 4) (ISTE-T 5) (McRel Tech 1,2,4,6)	CE 2, 4, 6
4. Analyze and apply proper techniques for a successful and safe 3D print for their classroom.	(NBPTS 1,2,4,5) (ISTE-T 2,4,5 6) (McRel Tech 1,6)	CE 2, 4, 6
5. Apply industry standards and techniques to help ensure classroom success when 3D printing.	(NBPTS 1,2,4,5) (ISTE-T 2,4,5,6) (McRel Tech 3)	CE 6
6. Adapt and integrate 3D printing into lessons to motivate and enrich the student experience.	(NBPTS 1,2,5) (ISTE-T 2,5,6) (McRel Tech 1)	CE 1, 2, 4, 6

Student Learning Outcomes for 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**
7. Complete an educational plan to match academic goals.	(NBPTS 1,2,3,4,5) (ISTE-T 5, 6) (McRel Tech 3, 4, 6)	CE 1, 2, 4, 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 Title	Module Assignments and Activities	Points Possible For Each Assignment
Begin Here	• Course introduction video • Introduce yourself forum • Course syllabus	
Module 1 – 3D Printing Overview	• Topics related to 3D printing in industry and education. • Watch: Screencasts and tutorials related to understanding the best hardware settings for a specific application. • Reading: Selected online reading • 1.1 Forum participation: Hardware and software. • 1.2 Forum participation: How you hope to integrate 3D printing in your instruction.	5 Points 5 Points
Module 2 – Modeling	• Topics related to obtaining and creating models to print. • Reading: Selected online reading • Watch: Self-paced video screencasts related to topics from this module along with a variety of supplemental video tutorials. • 2.1 Assignment – Finding 3D models for your classroom. • 2.2 Forum participation – Modeling programs for classroom use. • 2.3 Assignment – Your first 3D model.	5 Points 5 Points 5 Points

Module 3 – 3D Printers and Media	• Topics related to choosing and using the best equipment and materials. • Reading: Selected online reading • Watch: Self-paced video screencasts related to topics from this module along with a variety of supplemental video tutorials. • 3.1 Assignment: 3D printer evaluation. • 3.2 Assignment: Print media.	5 Points 5 Points
Module 4 – Preparing Models For 3D Printing	• Topics related to preparing files for 3D printing. • Reading: Selected online reading • Watch: Self-paced video screencasts related to topics from this module along with a variety of supplemental video tutorials. • 4.1 Assignment: Slicing. • 4.2 Assignment: Meshmixer introduction. • 4.3 Assignment – Meshmixer – slicing large models. • 4.4 Assignment – Meshmixer sculpting. • 4.5 Assignment – Safety.	5 Points 5 Points 5 Points 5 Points 5 Points
Module 5 – Using Your 3D Printer	• Topics related to actual 3D printing. • Reading: Selected online reading • Watch: Self-paced video screencasts related to topics from this module along with a variety of supplemental video tutorials. • Complete 3 assignments from the following list: o Printer Calibration, Benchmarking and Maintenance o Adding Magnets to Your Project o 3D Printing Molds o Photogrammetry - Creating 3D Models with a Phone/Camera o Troubleshooting 3D Printing Problems o A Proposal For Your Classroom	10 Points Each
Module 6 – Independent Project	• Student will apply topics covered in this course to create an instructional unit for your students that can be shared with your colleagues. • 6.1 Assignment/Forum Participation: Independent Project	10 Points
	• **TOTAL POINTS**	**100**

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. Include 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. Include 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 organization 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.

Forum Requirements

- **Superior:** Response was at least 1 page (3 fully developed paragraphs) in length. Thoroughly answered all the posed questions, followed all the assignment directions, proper grammar and no spelling errors. Language is clear, concise, and easy to understand. Uses terminology appropriately and is logically organized.
- **Standard:** Response was ½ to 1 page in length (2-3 fully developed paragraphs). Answered all the questions but did not provide an in-depth analysis, followed most of the assignment directions, proper grammar and no spelling errors. Language is comprehensible, but there a few passages that are difficult to understand. The organization is generally good.
- **Sub-standard:** Response was less than ½ page in length (1 paragraph). Did not answer all the required questions and/or statements or responses were superficial, vague, or unclear, did not follow the assignment directions, many grammar and spelling errors. Is adequately written, but may use some terms incorrectly; may need to be read two or more times to be understood.

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 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 90 hours on a typical 2-unit course or 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 - https://www.fresno.edu/students/registrars-office/academic-catalogs

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

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.