

## MAT-924 – Virtual Manipulatives

### Independent Study Online Course Syllabus

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**Number of Graduate Semester Units:** 3 units  
**Target Audience:** K - 12<sup>th</sup> grade teachers  
**Course Access:** [ce-connect.fresno.edu](https://ce-connect.fresno.edu)

#### Course Description

This online course will explore the use of web-based virtual manipulatives to engage K-12 students with important mathematics concepts. Teachers will investigate the nature of virtual manipulatives, compare and contrast them to traditional manipulatives, and discover ways of integrating them into their mathematics instruction. Specific resources and activities provided will encourage the development and use of appropriate standards-based lessons and activities using the manipulatives.

Teachers will become familiar with current research on the use of computer-based virtual manipulatives in the classroom. Based on this research and information gathered from online sources, teachers will design several lessons and activities that engage students in the use of virtual manipulatives. Teachers will relate these activities to their current standards-based math instruction and determine to what extent the lessons and activities have contributed to increased student achievement in mathematics. Teachers will collaborate and share their findings with their online community. This course can be completed with or without students.

**Note:** There is no required textbook for this course.

#### Required Texts and Course Materials

**Textbook:** There is no required textbook for this course.

**Note:** Several research-based journal articles are used with permission and available in pdf format in the course management system. Additional materials will include a variety online videos and web-based resources.

**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.

**Moodle:** Moodle is a web-based learning management system used to support flexible teaching and learning in both face-to-face and distance courses (e-learning).

<https://moodle.org> // <https://moodle.org/demo> // <https://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 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

### 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

### 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

| <b>Student Learning Outcomes for This Course</b><br>By the end of this course student will be able to:  | <b>National Standards Addressed in This Course*</b> | <b>Continuing Education Program Student Learning Outcomes Addressed**</b> |
|---|---|---|
| 1. Explore current research on the topic of virtual manipulatives and their use in the classroom  | NBPTS Prop. 4,<br>NETS 1                            | CE 1, CE 4, CE 6  |
| 2. Compare and contrast virtual manipulatives with traditional manipulatives and make recommendations on specific content well suited to the use of virtual manipulatives | NBPTS Prop. 3,<br>NETS II                           | CE 2, CE 4, CE 6  |
| 3. Demonstrate how to design a lesson or activity which engages students in important mathematics content through the use of virtual manipulatives                        | NBPTS Prop. 2, 3,<br>NETS III                       | CE 2, CE 3, CE 6  |
| 4. Implement and evaluate selected virtual manipulative-based lessons and demonstrate successful integration with standards-based math curriculum                         | NBPTS Prop. 5,<br>NETS IV                           | CE 2, CE 3, CE 6  |
| 5. Collaborate with peers and colleagues both in person and online to share insights, strategies, and deepen their professional practice                                  | NBPTS Prop. 5                                       | CE 1, CE 3, CE 4,<br>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

| <b>Module<br/>Module Title</b>   | <b>Module Assignments and Activities</b>   | <b>Points<br/>Possible<br/>for Each<br/>Assignment</b> |
|--|--|--|
| <b>Welcome Module</b>  | <ul style="list-style-type: none"> <li>• Introduction video</li> <li>• Course Syllabus</li> <li>• Moodle Online Tutorial</li> </ul>  |  |
| <b>Module 1 –<br/>Orientation and<br/>Introductions</b>                      | <ul style="list-style-type: none"> <li>• Introductions and goals for class.</li> <li>• Forum introductions</li> </ul>  | 4, 4   |
| <b>Module 2 –<br/>Teaching<br/>Mathematics with<br/>Manipulatives</b>        | <ul style="list-style-type: none"> <li>• Reflect on current use of manipulatives in mathematics instruction. Participate in forum discussion</li> </ul>  | 4  |
| <b>Module 3 –<br/>Virtual What?</b>  | <ul style="list-style-type: none"> <li>• Read article and NCTM position statement. Post an insight into using virtual manipulatives in the classroom.</li> </ul>                                   | 4  |
| <b>Module 4 –<br/>Current Research on<br/>Virtual Manipulatives</b>          | <ul style="list-style-type: none"> <li>• Research the rationale for integrating virtual manipulative use in the classroom. Read articles provided in this topic and summarize research.</li> </ul> | 4  |
| <b>Module 5 –<br/>Standards Analysis</b>                                     | <ul style="list-style-type: none"> <li>• Analyze standards that can be supported through manipulative-based instruction</li> </ul>   | 4  |
| <b>Module 6 –<br/>Sources for Virtual<br/>Manipulatives</b>                  | <ul style="list-style-type: none"> <li>• Explore and evaluate online virtual manipulative resources and activities. Network with online community via forum postings.</li> </ul>                   | 4  |
| <b>Module 7 –<br/>Virtual Manipulatives<br/>in Use</b>                       | <ul style="list-style-type: none"> <li>• Explore article and blog posts highlighting best practice implementation. Reflect on implementation insights.</li> </ul>                                  | 4  |
| <b>Module 8 –<br/>Lesson Design</b>  | <ul style="list-style-type: none"> <li>• Design and reflect on lessons. Collaborate with colleagues through sharing, posting, and evaluation of lessons.</li> </ul>                                | 4, 4   |
| <b>Module 9-<br/>Student Interactions<br/>with Virtual<br/>Manipulatives</b> | <ul style="list-style-type: none"> <li>• Summarize student virtual manipulative use.</li> </ul>  | 4  |
| <b>Module 10-<br/>Reflection</b>   | <ul style="list-style-type: none"> <li>• Participate in forum discussion addressing potential challenges.</li> </ul>   | 4  |
| <b>Course Wrap-up –<br/>Grading and<br/>Evaluation</b>                       | <ul style="list-style-type: none"> <li>• Course Evaluation</li> <li>• Course Completion Checklist</li> <li>• Grade Request / Transcript Request</li> </ul>   |  |
| <b>TOTAL POINTS</b>  |  | <b>48</b>  |

## 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 | Percentage | 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.

### **Discussion 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.

### **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.

### **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). Students with disabilities should contact the Academic Support Center

to discuss academic and other needs as soon as they are diagnosed with a disability. 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/students/academic-support/services-students-disabilities>.

## 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/registrar-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.

**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. Moodle is easy to learn and has a friendly user interface. To learn more about Moodle, go to [https://docs.moodle.org/33/en/Student\\_FAQ](https://docs.moodle.org/33/en/Student_FAQ). There are also some student tutorials on the Center for Online Learning website at Fresno Pacific University - <https://col.fresno.edu/student>.

**Moodle Site Login and Passwords:** Students will need to have internet access to log onto <https://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 communication. If you need help with your username and password recovery, please contact the Continuing Education office at (800) 372-5505 or (559) 453-2000 during regular office hours - Mon-Fri 8:00 am to 5:00 pm. or email them at [prof.dev@fresno.edu](mailto: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 <https://col.fresno.edu/contact/request-services>. Please identify that you are with the "School = Continuing Education".

## 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/students/registrars-office/academic-catalogs>.

## Fresno Pacific University Student Learning Outcomes

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| <b>Student Learning Outcomes Oral Communication:</b> Students will <i>exhibit</i> clear, engaging, and confident oral communication – in both individual and group settings – and will critically <i>evaluate</i> content and delivery components.   |
| <b>Written Communication:</b> Students will <i>demonstrate</i> proficient written communication by <i>articulating</i> a clear focus, <i>synthesizing</i> arguments, and utilizing standard formats in order to <i>inform</i> and <i>persuade</i> others.  |
| <b>Content Knowledge:</b> Students will <i>demonstrate</i> comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.   |
| <b>Reflection:</b> Students will <i>reflect</i> on their personal and professional growth and <i>provide evidence</i> of how such reflection is utilized to manage personal and vocational improvement.  |
| <b>Critical Thinking:</b> Students will <i>apply</i> critical thinking competencies by <i>generating</i> probing questions, <i>recognizing</i> underlying assumptions, <i>interpreting</i> and <i>evaluating</i> relevant information, and <i>applying</i> their understandings to new situations.   |
| <b>Moral Reasoning:</b> Students will <i>identify</i> and <i>apply</i> moral reasoning and ethical decision-making skills, and <i>articulate</i> the norms and principles underlying a Christian world-view.   |
| <b>Service:</b> Students will <i>demonstrate</i> service and reconciliation as a way of leadership.  |
| <b>Cultural and Global Perspective:</b> Students will <i>identify</i> personal, cultural, and global perspectives and will employ these perspectives to <i>evaluate</i> complex systems.   |
| <b>Quantitative Reasoning:</b> Students will accurately <i>compute</i> calculations and symbolic operations and <i>explain</i> their use in a field of study.  |
| <b>Information Literacy:</b> Students will <i>identify</i> information needed in order to fully understand a topic or task, <i>explain</i> how that information is organized, <i>identify</i> the best sources of information for a given enquiry, <i>locate</i> and critically <i>evaluate</i> sources, and accurately and effectively <i>share</i> that information. |