COURSE SYLLABUS

FRESNO PACIFIC UNIVERSITY
CENTER FOR PROFESSIONAL DEVELOPMENT

MAT 912 Great Mathematicians Before 1700

Instructor: Wilbert Reimer
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Number of Units: 3 Semester Units
Grade Level: 3 - 12

Course Description

Students are consistently surprised and excited to discover that mathematics comes from real human beings like themselves. Much of the fear and apprehension towards mathematics is alleviated when students realize how it originated--usually from a real-life problem that needed solving.

As students hear stories about mathematicians and engage in problems similar to the ones these mathematicians worked with, they begin to see that all of mathematics is inter-connected. They discover that mathematics is, in fact, inter-connected with almost everything in our daily lives.

Implementing historical elements into the teaching of mathematics will

- excite students about mathematics.
- increase motivation and interest.
- help students gain an appreciation of the contributions of all cultures.
- provide an effective lead-in to a new area of study.
- provide many opportunities to utilize manipulatives and hands-on learning.
- show that mathematical accomplishment is not limited by race, ethnicity, gender or ability.
- show that people overcame prejudice, obstacles and pain to create mathematics.
- provide a natural way to integrate reading, writing, and other curricular areas.
- provide a bridge from the past to the future.
- help students see how mathematics has developed over the centuries.

In this course, teachers will read stories about mathematicians who lived before 1700. They will complete, design, and teach activities related to the mathematics those mathematicians developed. Course assignments ask participants to identify specific state or national standards addressed through the lessons presented. This course was developed to support the objectives of the Common Core State Standards and the NCTM (National Council of Teachers of Mathematics) Math Standards.

Course Dates:

This course is self-paced; students may enroll at any time and take up to a year to complete assignments. No course should be completed in less than three weeks (one week per credit).

Course Materials

Texts for this course are all included.

Reimer, Luetta, and Wilbert Reimer. *Mathematicians Are People, Too,* Volumes 1 and 2. Palo Alto, CA: Dale Seymour Publications, 1990, 1994.

Reimer, Wilbert, and Luetta Reimer. *Historical Connections in Mathematics,* Volumes 1, 2, and 3. Fresno, CA: AIMS Education Foundation, 1992, 1993, 1994.

Included with the course instructions is an appendix of supplementary materials and resources. Information about Fresno Pacific University, the Center for Professional Development, and the instructor, plus details on course policies and procedures is also included.

Course Requirements

To complete this course satisfactorily, participants must submit

1) a short paper of insights from essay readings OR a list of recommended websites,

2) ten sets of discussion questions based on the stories selected for reading from *Mathematicians Are People, Too*,

3) photocopies of eight completed activities,

4) two lesson plans for teaching about a mathematician and his or her work,

5) an evaluation of the teaching* of one of the above lessons.

See the "Schedule of Topics and Assignments" for more details on these assignments.

All work should be typed and sent to the instructor at one time when the course is completed. Please make a copy; work will not be returned. Students have one full year to finish the course but should not send completed work in less than three weeks from registration.

Send completed work by email attachments to: wreimer@fresno.edu

OR

Mail all the above items to:

Wilbert Reimer
1549 S. Lind Avenue
Fresno, California 93727

IN EITHER CASE, request online grading: http://ce.fresno.edu/cpd

National Standards

Common Core Standards for Mathematics

a. Problem Solving
Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals.

b. Reasoning
Mathematically proficient students make sense of quantities and their relationships in problem situations.

c. Constructing Arguments
Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments.

d. Modeling
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace.

e. Using Strategic Tools
Mathematically proficient students consider the available tools when solving a mathematical problem.

f. Attending to Precision
Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning.

g. Using Structure
Mathematically proficient students look closely to discern a pattern or structure.

h. Expressing Repeated Reasoning
Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts.

National Board for Professional Teaching Standards: Five Core Propositions

In addition to the content standards referenced above, this course supports the following core propositions that characterize National Board Certified Teachers (NBCTs).

Proposition I: Teachers are Committed to Students and Their Learning

- NBCTs are dedicated to making knowledge accessible to all students. They believe all students can learn.
- They treat students equitably. They recognize the individual differences that distinguish their students from one another and they take account for these differences in their practice.
- NBCTs understand how students develop and learn.
- They respect the cultural and family differences students bring to their classroom.
- They are concerned with their students' self-concept, their motivation and the effects of learning on peer relationships.

Proposition 2: Teachers Know the Subjects They Teach and How to Teach Those Subjects to Students.

- NBCTs have mastery over the subject(s) they teach. They have a deep understanding of the history structure and real-world applications of the subject.
- They have skill and experience in teaching it, and they are very familiar with the skills gaps and preconceptions students may bring to the subject.
- They are able to use diverse instructional strategies to teach for understanding.

Proposition 3: Teachers are Responsible for Managing and Monitoring Student Learning.

- NBCTs deliver effective instruction. They move fluently through a range of instructional techniques, keeping students motivated, engaged and focused.
- They know how to engage students to ensure a disciplined learning environment, and how to organize instruction to meet instructional goals.
- NBCTs know how to assess the progress of individual students as well as the class as a whole.
- They use multiple methods for measuring student growth and understanding, and they can clearly explain student performance to parents.

Proposition 4: Teachers Think Systematically about Their Practice and Learn from Experience.

- NBCTs model what it means to be an educated person—they read, they question, they create and they are willing to try new things.
- They are familiar with learning theories and instructional strategies and stay abreast of current issues in American education.
- They critically examine their practice on a regular basis to deepen knowledge, expand their repertoire of skills, and incorporate new findings into their practice.

Proposition 5: Teachers are Members of Learning Communities.

- NBCTs collaborate with others to improve student learning.
- They are leaders and actively know how to seek and build partnerships with community groups and businesses.
- They work with other professionals on instructional policy, curriculum development and staff development.
- They can evaluate school progress and the allocation of resources in order to meet state and local education objectives.

Learning Outcomes

Participants in this course will be able to

1. identify and discuss some of the great mathematicians of the past and teach information about their contributions. (NBPTS Props, 1-5)

2. develop and experiment with a variety of approaches for implementing history into their mathematics classrooms. (CCSS a-h; NBPTS Props. 1, 2, 3 & 4)

3. design activities for classroom use. (CCSS a-h; NBPTS Props. 1, 2, 3 & 4)

4. articulate the importance of teaching mathematics from a historical perspective and gain creativity and self-assurance as these important concepts and truths are introduced to students. (NBPTS Props. 2, 3 & 4)

5. demonstrate how the activities are connected to a standards based curriculum. (NBPTS Prop. 5)

Schedule Of Topics And Assignments

A. Reading Component:

1. Read "Connecting Mathematics with Its History: A Powerful, Practical Linkage," and "Happy Birthday, Galileo!" found in the appendix.

2. Read 10 of the following stories found in *Mathematicians Are People, Too*, Volumes 1 and 2:

   "Pyramids, Olives, and Donkeys" (Thales)
   "The Teacher Who Paid His Student" (Pythagoras)
   "There's Only One Road" (Euclid)
   "The Man Who Concentrated Too Hard" (Archimedes)
   "A Woman of Courage" (Hypatia)
   "A Fortune Shared" (Khayyam)
   "Lean on the Blockhead" (Fibonacci)
   "The Conceited Hypochondriac" (Cardano)
   "Magician or Mathematician?" (Napier)
   "Seeing Isn't Believing" (Galileo)
   "The Stay-in-Bed Scholar" (Descartes)
   "An Amateur Becomes a Prince" (Fermat)
   "Count on Pascal" (Pascal)
   "The Short Giant" (Newton)

B. Activity Component:

1. In a total of 200-300 words, identify three insights or ideas gained from the reading of the essays in the course appendix.

   OR

   Persons who have previously completed MAT 913 are encouraged to use this alternative assignment: Identify and briefly describe three websites about the history of mathematics that you would recommend to your colleagues or students (one paragraph per site).

2. For each of the stories you select to read, create four questions to test your students' listening and comprehension skills. If they know the reading in class will be followed by questions, students are more likely to listen carefully and to retain what they hear. Such questions also provide an opportunity to emphasize specific ideas and/or explain confusing concepts. You will have 10 sets of four questions. (See "Sample Reading Questions" in the course appendix.)

3. Choose *four* mathematicians from the "Mathematicians Before 1700" list in the appendix. For each of the four mathematicians you have chosen, complete two activities from the three-volume *Historical Connections* set. The intent here is that you, as the teacher, should become personally familiar with some of the mathematics related to these mathematicians.

   Photocopy the completed activities (a total of eight) and submit these with your coursework.

4. Building Lesson Units:

   a. Design two units appropriate to your classroom setting and level. (See "Sample Lesson Unit" included in the course appendix.) Each unit should include (but is not limited to) the following five components:

      1) a statement of goals/objectives for the lesson.
      2) biographical or anecdotal information on the person under study.
      3) two activities to teach or reinforce learning of concepts. Use activities from the texts in this course, another appropriate resource, or create your own. Be imaginative as you design a learning experience likely to engage your students.
      4) one "connecting" element utilizing writing, art, drama, science, or some other curricular area. (See the list of "Suggested Connecting Activities" in the appendix or review the article, "Connecting Mathematics with its History" for ideas and examples.)
      5) a statement indicating which of the national or state standards in mathematics are addressed by the lesson.

   b. Teach* one of these units and evaluate* the experience. The evaluation should include (but is not limited to) the following elements:
      1) Grade level and topic covered.
      2) How did students respond to the lesson? to the story or anecdote? to the activities?
      3) How did you measure the learning of your students?
      4) What would you do differently if you were to teach this lesson again?
      5) Did incorporating historical elements in mathematics teaching detract from or contribute to your regular curriculum? Explain.
      6) Other comments?

***Note:** **If you wish to complete this course while you are *not* teaching, prepare the lessons for future use in your classroom. If you prepare one additional lesson unit (for a total of three) you may omit the teaching and evaluation of the lesson (section b) without penalty.**

Evidence of Learning

- Instructor observed evidence of understanding of course objectives as demonstrated through student's reflective writing assignments. (Outcomes 1-4; Assignment B1)
- Instructor observed evidence of understanding mathematical terminology and procedures as demonstrated through student's completed activities. (Outcomes 1, 2 & 6; Assignments B2 & 3)
- Student demonstrated openness towards and creative use of a variety of learning methodologies and strategies. (Outcomes 1, 2, 3& 4; Assignments B1-4)
- Student demonstrated his/her understanding of effective design of lesson plans. (Outcomes 3 & 4; Assignments B2 & 4)
- Student reflected the use of critical thinking skills (Outcomes 1, 2 & 4; Assignment B1)
- Student made connections to state content and/or professional teaching standards. (Outcome 5; Assignments B4)

Grading Policies and Rubric

Grades will be determined using the following percentages:

Insights from readings OR list of recommended websites: 10%
Questions generated for ten stories: 30%
Eight completed activities: 10%
Classroom lesson plans on two mathematicians: 40%
Evaluation* of teaching experience: 10%

Coursework is to be typed. Follow course instructions carefully.

Total scores determine the final grade:

90 - 100% = A
80 - 89% = B
79% or below = no credit

All coursework must reflect a minimum "B" quality to receive credit. The discernment between an A and a B is at the discretion of the instructor, based on the quality of work submitted (see assignment rubric). Participants may request either a letter grade (A or B) or credit (CR). Coursework falling short of a "B" or CR grade will be returned with further instructions. Every person with a score of 80% or above will receive three semester units of credit.

Scoring Rubric

Type of Assignment	90 – 100 points Exceptional	80 – 89 points Adequate	70 – 79 points Not Acceptable
Written responses	Student's written responses show an exceptional investment of time, energy and thoughtful reflection. The work submitted by the student is original and thorough. The student effectively organizes key insights and demonstrates evidence of interaction with the texts and exercises.	Student's written responses show an adequate investment of time, energy and thoughtful reflection. The work submitted by the student is complete, but lacks thoroughness and originality. The student sufficiently organizes insights and demonstrates evidence of interaction with the course activities.	Student's written responses show little investment of time, energy and thoughtful reflection. The work submitted by the student does not show adequate thought or effort.
Lesson Design	Lesson plans show an exceptional investment of time, energy and thoughtful reflection. Student consistently makes connections to local instructional goals/standards and implements research-based strategies and approaches.	Lesson plans show an adequate investment of time, energy and thoughtful reflection. Student makes some connections to local instructional goals/standards and research-based strategies and approaches.	Lesson plans submitted by the student do not show adequate thought or effort, and may not address specific goals.
Lesson evaluations	Student includes the use of critical thinking and reflection in the evaluation of lessons implemented.	Student includes the use of reflection in the evaluation of lessons implemented, but may lack sufficient detailed analysis.	Student does not demonstrate critical thinking or reflection in the evaluation of lessons implemented.
Presentation	Student effectively organizes key insights into a thoughtful and well-structured presentation.	Student includes several key insights in a presentation.	Student presentation lacks key insights.
Research	Research accesses multiple sources available via the internet. Web descriptions demonstrate thorough engagement with site information.	Research accesses sources available via the internet. Web descriptions demonstrate adequate engagement with site information.	Research fails to access sources available via the internet. Web descriptions demonstrate little engagement with site.

Instructor/Student Contact

Students are warmly invited to contact the instructor at any time with concerns, questions, or comments related to course work. They are specifically asked to do after finishing section A: Reading Component. At the completion of the course, the instructor will comment on the student's work and make suggestions, if needed.

Policy on Plagiarism

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 according to the procedures set forth in the Fresno Pacific University Catalog.

University Information

Graduate level course work reflects Fresno Pacific University's Desired Student Learning Outcomes as it applies to professional development to demonstrate the following:

- Oral and written communication in individual and group settings
- Content knowledge, and application of such knowledge in the student's area of interest to affect change
- Reflection for personal and professional growth
- Critical thinking
- Computational/methodological skills to understand and expand disciplines, including an understanding of technological systems