

Teaching Portfolio

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1. Description of position held at the University of Arizona

At the University of Arizona I held a joint teaching/CEMELA post-doctoral position between 2004-2007. As a teaching post-doc I taught at least 9 units per year (see pages 3-4) and participated in other teaching-related activities of the department (see pages 5-6). As a CEMELA post-doc I co-coordinated an after-school Math Club (see page 6), conducted research at this site and participated in other CEMELA activities.¹

Description of the teaching post-doctoral position:

”These positions are similar to post-doctoral positions in research except that the emphasis is on teaching and scholarly activities pertaining to teaching. Teaching post-docs have the opportunity to teach a wide range of undergraduate courses and to participate in departmental activities such as research seminars, curriculum reform, projects with undergraduates, and outreach activities like teacher training programs. ”

(taken from http://math.arizona.edu/employment/tpd_intro.html)

Description of the CEMELA position:

“The Center for Mathematics Education of Latinos/as is an interdisciplinary, multi-university consortium focused on the research and practice of the teaching of mathematics to Latino/a students in the United States. . . .

Teaching opportunities include mathematics content courses for pre-service teachers and for practicing teachers (K-12), mathematics pedagogy courses for pre-service secondary teachers, and other mathematics courses depending on the mathematics education program needs. Engage in research with a focus on mathematics teaching and learning with Latino populations in schools, family, and community settings. Collaborate in CEMELA graduate core program (e.g., CEMELA Seminar and Short Courses).”

(taken from http://math.arizona.edu/employment/cemela_intro.html)

¹More information is available in the Curriculum Vitae.

2. Overview of Teaching Responsibilities

In all the courses I taught at the University of Arizona, I created weekly course notes or handouts, created quizzes (except in 505F), created midterms and final exams (except in 124, 115A, where the final is common to all sections), assigned and/or created homework (except in 120R, 124, 115A, where homework is common to all sections) and maintained detailed web-pages (go to <http://math.arizona.edu/~ksimic>). The other details or additional work I did for each class are stated below under "Notes."

Courses taught:

Fall 2004

Math 120R: Calculus Preparation

Typical student population: Engineering

Notes: The class has a lab component.

Math 124: Calculus with Applications

Typical student population: Engineering

Notes: The course is taught from a reform calculus textbook.

Spring 2005

Math 115A: Business Mathematics (A)

Typical student population: Business

Notes: The class is project- and Excel-based.

Math 302A: Understanding Elementary Mathematics (A)

Typical student population: Education

Notes: For a final project, students made posters about an article from a teaching journal.

Fall 2005

Math 302B: Understanding Elementary Mathematics (B)

Typical student population: Education

Notes: Students wrote summaries of NCTM articles. Geometer's Sketchpad was used in the course.

Math.CS/Phil 402/502: Mathematical Logic

Typical student population: Mathematics, CS

Notes: For the project, the students reported on an application or theorem of mathematical logic. I chose the textbook for the course and created a take-home final.

Spring 2006

Math 215: Intro to Linear Algebra

Typical student population: Mathematics, Engineering

Notes: For the project, students studied an application of linear algebra. Maple was used in the course.

Fall 2006

Math 105: Math in Modern Society

Typical student population: Education, Journalism, Arts

Notes: The project consisted of creating a five-year financial plan culminating in buying a house. Students wrote summaries of each chapter covered. I showed movies related to the material.

Math 505F: Geometry for K-8 Teachers

Typical student population: Middle school teachers

Notes: This was the first time the course was offered. I created the entire curriculum, which consisted of readings and handouts. Geometer's Sketchpad was used in the course.

Spring 2007

Math 302A: Understanding Elementary Mathematics (A)

Typical student population: Education

Notes: Students wrote summaries of articles from NCTM journals. For the final project, pairs of students presented an activity they had found in a practitioner journal.

Fall 2007

Math 120R: Calculus Preparation

Typical student population: Biology

Notes: The class has a lab component. We looked at applications of precalculus to biology. Students wrote summaries of all the chapters.

3. Undergraduate Research Projects

The University of Arizona Mathematics Department has an extensive undergraduate research assistant (URA) program. The following is the excerpt of my description posted on the department's URA page:

As most students get little (if any) exposure to mathematical logic in the course of their studies, my goal for this project is to introduce the interested student to mathematical logic in an engaging and non-intimidating manner. The project topic is loosely defined, as it will depend on student backgrounds and interests. If a student has no previous experience with mathematical logic, then we will spend the first part of the semester getting acquainted with the subject (propositional logic, first-order logic, relevance to mathematics, historical developments, some seminal results such as the completeness theorem and the incompleteness theorems).

Once the student is ready to choose a topic, we will find an appropriate one together. I am mainly interested in intuitionistic logic (description follows below), and its use in proving the usual theorems of mathematics, but would also be willing to work on a project in other areas of logic, especially category theory. I am also interested in working with students with backgrounds in linguistics or philosophy or those interested in the history of mathematics, in which case we could study a topic relevant to all fields involved. ...

I worked with four students between 2004-2007, on the following projects:

- Formulas for Computable Functions (published in the Rose Hulman Undergraduate Mathematics Journal) with Samuel Alexander
- An Excursion into Set Theory Using a Constructivist Approach with Nikhil Patil
- The Constructivist Intermediate Value Theorem with Joseph Thomas
- Notes on the Structure of the Hyperreals with Thomas Laetsch

The first student came to me with a work in progress, while the others had no previous knowledge of logic when they started working on the project. In each case I would meet with the students once or twice a week, discuss his progress, answer questions, recommend further readings and suggest problems to solve. At the end of the semester, each student submitted a typed final report about the topic he had researched over the course of the semester, in the form of a research paper.

4. Outreach

I have been involved in a number of outreach projects. The main ones are:

- Sonia Kovalevski High School Mathematics Days

The University of Arizona Mathematics Department hosted the Sonia Kovalevski Day in 2006 and 2007. I was one of the three main organizers for both. We applied to and received funding from AWM, to hold a day-long workshop for local female high school students, predominantly Latina and Native American, with the purpose of encouraging them to pursue careers in mathematics and sciences. My contributions were:

2006: Co-writing the grant; planning the activities; running an introductory workshop and problem-solving session in basic mathematical logic;

2007: Co-writing the grant; recruiting the students; planning the activities; running an introductory workshop and problem-solving session in basic graph theory.

The program's web-page is available at

<http://math.arizona.edu/~ksimic/SKDay07.html>

- Native American Summer Institute ("Beepop")

The Native American Summer Institute is a three-week program for local Tohono O'odham and Yaqui high school students that consists of the following components: school mathematics review, learning about mathematical modeling (with a focus on modeling a beehive), and making a two-year business plan for running an apiary in order to apply to a bank for a loan. I helped with the institute in 2005 and 2006. My duties consisted of assisting during the first two activities, and running the third: beekeeping economics. In beekeeping economics the students learned about revenue and profit, loans and interest, and learned the basics of Excel and PowerPoint.

- After School Math Club

I was part of a team that created the curriculum for, coordinated and facilitated an after school Math Club for elementary school students at a local school between 2005-2007. The school is located in a primarily Latino/a neighborhood. The club was bilingual, meet twice a week, and was mostly project-based, with the projects incorporating the students' everyday experiences.

Appendix A: Sample Syllabus

Available at <http://math.arizona.edu/~ksimic/215policy.html>

MATH 215, Intro to linear algebra, Spring 2006

Read the course policies frequently. Knowing them can prevent misconceptions and problems in the future.

Course objective: According to a number of people, linear algebra may be the most useful mathematics class that you can take in college. It has many applications in science, industry, economics and other fields. It is a subject that you will very likely use in your work, whatever your future profession may be. However, linear algebra is not only useful, but also a beautiful branch of mathematics; and if you are interested less in applications, and more in elegant theorems, it is again a fascinating subject to learn. My hope is that, regardless of whether you prefer theory or applications, you will find this course interesting and relevant. We will discuss the basic elements of linear algebra: matrices, determinants, vector spaces, inner product spaces. We will both prove many of the relevant theorems and spend time looking at practical applications. You will get a chance to do the same on your own, both by solving problems and participating in discussions during class, and in the project that you will be required to do: here you will get to explore topics that we may not get to in class, but that interest you. We will divide the class time between lecture, class discussions and group work (the structure of the course is explained in more detail below). My ultimate goal is to create a motivating, safe learning environment for all the students in the course, to engage your attention, and to encourage you to pose questions and solve problems on your own. By the end of the semester, you should be able to understand the workings of linear algebra in many fields where it is used; you should also understand the structure of proofs better and be able to write proofs more successfully.

Attendance: Attendance will mostly not be taken. I will, however, take attendance during the first two weeks of the course; also, a student who is constantly absent from class may be administratively dropped. It is, of course, in your best interest to come to class, not only because most effective learning occurs during this time, but also because I will give quizzes on most weeks, and on other days you will be working in groups (some of this work will be graded). If you are not present during a class period, you are responsible for the missed work.

Notes: I am going to type and put up lecture notes for most topics. I will follow these notes rather closely, so I urge you to print them and bring them to class.

Homework: There will be two types of homework for this class: first, there will be one or two problems assigned every day, as daily homework; we will begin work on these problems during the last ten minutes of class: you will divide into groups of 3-4 and discuss these problems. You will then finish them at home and turn in at the beginning of the next class period. Second, there will be a longer homework set assigned every Monday; this will be the weekly homework that you will have a week to work on. It will consist of concept questions, definitions, computational problems and more complex, theoretical problems. It will be due by 5 pm on the Monday that it is due. We may stray from this schedule on rare occasions, such as test weeks and break weeks.

Homework is worth 25% of the grade. Each daily assignment is worth 10 points, and each weekly assignment is worth 100 points. Your three lowest daily homework scores will be dropped, as well as one lowest weekly homework score. Collaboration on homework is allowed and encouraged, but it is essential that you write up your own solutions, and write on your assignment the names of all persons you were working with. All solutions must be sufficiently explained and assignments must be stapled when turned in. A sufficient explanation does not mean listing all steps used in solving a problem, but explaining your reasoning, and why your solution is valid. Your classmate who has not solved the problem should be able to understand it fully from your solution.

Quizzes: There will be a number of brief, individual quizzes at the beginning of class. They will usually be announced. There will also be occasional problem-solving sessions, where you will work on problems in groups, and turn them in at the end of class.

Project: Students will pair up in mid-February to research a topic related to linear algebra. The completed projects will be due mid-April. I will provide you with a list of possible topics, but you are encouraged to choose one on your own. You will write a 5 page paper on this topic. I will provide you with more details in due time. Expect to present your projects in class.

Exams: There will be two in-class exams during the semester. Their dates will be determined in class (by vote). Tentatively, you should expect the first midterm in the middle of February, and the second in early April.

Final exam: I will announce the date of the final as soon as it becomes known. It will be a cumulative test, containing portions of most of the material covered throughout the semester. Do not make plans to leave before the final. You will not be able to take the exam early.

Make-up policies: Make-up exams are given only when there is a valid excuse, such as a medical or family emergency, proof of which has to be provided.

Grading:

Homework 25%

Quiz/group work 10%

Exams 15% each

Project 10%

Final exam 25%

Grades will be no lower than the following:

A: 90%-100% B: 80%-89% C: 70%-79% D: 60%-69% E: 0%-59%

Drop date: The last date to drop is Tuesday, February 7.

Withdrawal/Incomplete: The last day to withdraw with a W, with the instructor's permission, is Tuesday, March 7. The University allows withdrawals after that date, but only with the Dean's signature. Late withdrawals will be dealt with on a case to case basis, and requests for late withdraw with a W without a valid reason may not be honored. The grade of I will be awarded if all the following conditions are met: The student has completed all but a small portion of the required work. The student has scored at least 50% on the work completed. The student has a valid reason for not completing the course on time. The student agrees to make up the material in a short period of time. The student asks for the incomplete before grades are due, 48 hours after the final exam. Academic honesty: All cases of cheating and plagiarizing will be dealt with as specified in the Code of Academic Integrity and Student Code of Conduct.

I look forward to working with you. If you have any questions, concerns, complaints, feel free to talk to me. If you work regularly, attend class and office hours, you have every reason to succeed in this course.

Appendix B: Sample Handout

Available at <http://math.arizona.edu/~ksimic/302bhandouts.html>

Math 302B, Section 3

November 16-18, 2005

Introduction to volume

Answer the following question: What is volume? How do you explain this concept to a child who has never worked with volume before? (In particular, think of volume of a box.) How is volume related to area? Out of all boxes with the same surface area, which one do you think has the largest volume?

Problems:

1. Situation: 27 sugar cubes have been stacked to form a cube. The outside of the large cube has been colored with red food coloring.
 - (a) What are the dimensions of the cube? (Assume each sugar cube is 1cm x 1 cm x 1cm.)
 - (b) How many sugar cubes are painted:
 - i. on four sides?
 - ii. on three sides?
 - iii. on two sides?
 - iv. on one side?
 - v. on zero sides?
 - (c) Imagine you stacked 64 sugar cubes in the same way and painted the outside. Answer questions (b)i through (b)v for this cube.
 - (d) Can you stack 1,000,000 sugar cubes on the teacher's desk? Explain your answer.
(taken from *Ideas from the arithmetic teacher, grades 6-8*)
2. You work for a company that wants to arrange 24 blocks in the shape of a rectangular prism and then package them in a box that exactly fits the prism. Find all the ways 24 cubes can be arranged into a rectangular prism. Make a sketch of each arrangement you find, and give its dimensions and surface area. Which arrangement requires the least amount of material to make the box? Which arrangement needs the most material? You can use interlocking cubes.
3. Let's say we have a box that is $2 \times 3 \times 5$. The company from the previous problem wants us to build a box that will hold twice as many cubes. What are the dimensions of a box that contains twice as many cubes as this box? List all the different combinations that you find. Compare the surface areas of the different boxes. You can use interlocking cubes.

4. Suppose in the previous problem you doubled the dimensions of the box. What happened to the surface area? What happened to the volume? Make a general conjecture.
5. When packaging a given number of cubes, which rectangular arrangement uses the least amount of packaging material? First answer the question for 8 cubes, 27 cubes, 12 cubes. Then make a general conjecture.
6. How many cube packages that are $2 \times 2 \times 2$ will fit in a box that is $8 \times 8 \times 4$? How many packages that are $4 \times 4 \times 4$ will fit in the same box?
7. Start with two identical sheets of paper. Tape the long sides of one sheet together to form a cylinder. Form a cylinder from the second sheet by taping the short sides together. Imagine that each cylinder has a top and a bottom. Which cylinder has greater volume? Explain your reasoning. Which cylinder has greater surface area? Explain your reasoning.

Activities:

Activity 1. Take a cylinder and cone that have the same base and height. Fill the cone with water. Figure out how many times you need to empty the cone into the cylinder to fill it up.

Activity 2. Repeat the previous activity for a prism and pyramid.

In both cases, do you think that there is a general relationship that holds?

Activity 3: Using play dough, make a sphere with a diameter between 2 inches and 3.5 inches. Using a strip of transparent plastic, make a cylinder with an open top and bottom that fits snugly around your sphere. Trim the height of the cylinder to match the height of the sphere. Tape the cylinder together so that it remains rigid. Now, flatten the sphere so that it fits snugly in the bottom of the cylinder. Mark the height of the flattened sphere on the cylinder. Measure and record the height of the cylinder, the height of the empty space, and the height of the flattened sphere. What is the relationship between the volume of the sphere and the volume of the cylinder?

Appendix C. Sample Project Description

Available at <http://math.arizona.edu/~ksimic/215project.html>

MATH 215, Intro to linear algebra, Spring 2006

Instructions for the project: Below you will find a list of project topics as well as links to other pages with more ideas and sample projects (which of course you should only look at and not use in any way). Once you choose a topic, you will consult books, journals, experts in the area and/or the Internet to compose a paper.

As is common in actual research, you will first turn in a one-page typed outline of your project. It should include its title and subject, the names of persons working on it, possible references (if you know them at this point), the connections of the particular topic with linear algebra and your "plan of attack."

You will next turn in a rough draft 10 days before the actual paper is due. I will read the draft, make comments and suggestions, and return it to you as soon as possible, so you can make appropriate changes.

The final paper should be at least five pages long (not counting graphs, tables, pictures, diagrams etc.) and be a clear and detailed exposition of the topic it discusses. It should contain your own title, introduction (in which the reader, who is assumed to have no prior knowledge is introduced to the subject), conclusion, references (all the sources you used, both indirectly, in preparing the paper, and directly, by quoting or paraphrasing; you may not use previous projects!), and other labeled sections of your choice. You are encouraged to include graphics and use computer software.

The paper should be typed, including formulas. See me if you don't know how to do this.

Timeline: February 8: Know who you are working with (or if you are working alone). Start looking at project topics.

March 1: Have a project topic

March 6: Submit a one-page project proposal

April 10: Submit draft

April 21: Final drafts due.

A good place to start is <http://commons.bcit.ca/math/examples/>.

How to choose a project topic? It is best to choose a topic that is close to your field of study or interest. Do some research on your own. See what strikes your fancy. There are some recommended topics below, but you are more than welcome to come up with a topic on your own. You can also talk to me about it.

The topics that I recommend are:

Population Growth, Birth and Death Models
Leontiev's Model of the Economy
Classification of Quadric Surfaces in R^3
Fourier Series
Iterative Methods for Solving Systems of Linear Equations
Equilibrium in Networks
Fractals from Affine Transformations
Discrete Dynamical Systems
Applications to Genetics
Graph Theory and Matrices
Computed Tomography
Computer Graphics
Symmetry Groups in 2 and 3 Dimensions
Systems of Linear Differential Equations
Markov Chains in Probability Theory
Oscillatory Systems
Linear Programming and the Simplex Method
Matrix Cryptography
(thanks to Professor Grove)

I am not familiar with all these topics myself, so I encourage you to do some research on your own before you come to talk to me (a quick search on Google or in Wikipedia should give you a general idea about a topic). Some other links:

<http://online.redwoods.cc.ca.us/instruct/darnold/laproj/>

http://www.prenhall.com/divisions/esm/app/ph-linear/leon/html/proj_intro.html

Enjoy!!!