Building Skills, Confidence and Community
in Freshmen Mathematics Majors

2004 Joint Mathematics Meetings
Phoenix, AZ

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Workshop in Mathematics Course
Documentation
http://www.lacteonline.org/
Curriculum/ jackie/abstract.htm

Two Semester
Workshop-Course Sequence
for Mathematics Majors

Goals:

- improve mathematical problem solving and communication skills,

- increase students' confidence in their abilities in these areas

- form a sense of community

- inform them of career opportunities

- excite them about the relevance and impact of mathematics on society

LMU Math Major Dropout Rate

Before Workshop Course Sequence

1987-1991   30%

After Workshop Course Sequence

1992-2000   16%

Two Semester
Workshop-Course Sequence
for Mathematics Majors

Four Components:

1. **Problem Solving**

2. **Mathematical Communication and Study Skills**

3. **Modern Mathematics and Mathematical Culture**

4. **Mathematical Careers and People**

Two Semester
Workshop-Course Sequence
for Mathematics Majors

Features:

- **meets for three hours each week**

- **treats at least three of the four components each week**

- **is intended for freshman math majors**

- **is open to other students at or beyond the precalculus level**

- **is recommended for sophomore transfers**

- **guest lectures are advertised and open to all students**

Mathematical Writing Skills
Activities/Assignments

Learning to Write Mathematics

    Writing Samples for Students

    Incorrect Math

    Use Proper English, Mathematical Terms, and
           Write in Complete Sentences

    Strike a Balance Between Words and Symbols

    Honor the Equal Sign

    Use Different Letters for Different Things

    Define Terms and Notation

    Give Reasons

    Watch Those Pronouns

End-of Semester
Mathematical Term Paper & Talk or Poster Paper

Writing to Learn Mathematics

    Two Minute Reflections

    Mathematical Writing in Other Courses

    Portfolio Writing Assignment

MATHEMATICAL WRITING SKILLS

Price, J. J. "Learning Mathematics Through
   Writing: Some Guidelines," *The College
   Mathematics Journal.* Vol. 20, No. 5
   (November 1989) pp.393-401

PROBLEM SOLVING

Afflack, Ruth. *Beyond Equals.* [Oakland]
   Math/Science Network, 1982.

Polya, George. *How to Solve It.* [Princeton]
   Princeton University Press, 1957.

Schoenfeld, Alan H. *Mathematical Problem
   Solving.* [Orlando, FL] Academic Press,
   1985.

Understanding the Problem

A first problem in class:

You have two square remnants of imported fabric; the side of one square is 3 yards and the side of the other is 4 yards. Suppose you cut each of the squares into two pieces and arrange the four pieces into one larger square. What are the dimensions of the resulting square?

First Writing Assignment

Write up a solution to the problem discussed in class. You are writing this solution for a classmate who missed class.

First Problem Solving Assignment

Spend 15 minutes trying to find what cuts, if any, would satisfy the conditions of the problem. <u>Record all your thinking and attempts as you go along. Hand that in</u> even if you do not find cuts that will let you rearrange the 4 pieces into a 5 x 5 square.

Polya's Step 4:
Looking Back Questions

Is it actually possible to carry out the cutting and rearranging of the cloth?

What else can we think about this problem?

Does it remind us of anything?

Are the numbers 3, 4, and 5 special?

So we need special numbers to make this problem work?

What if we change the shapes of the pieces of cloth?

What if we change the number of pieces we cut the cloth into before we rearrange the pieces?

Workshop-Course Peer Review Sheet

Peer Review of _____'s Problem #____

by _____ Due date:____

1.	Is the answer correct?	YES	MAYBE	NO
2.	Is the mathematical argument correct?	YES	MAYBE	NO
3.	Are there reasons given for each step?	YES	MAYBE	NO
	a. Is there enough mathematics or notation in the explanation?	YES	MAYBE	NO
	b. Are there enough words of explanation?	YES	MAYBE	NO
4.	Is the mathematical notation good?	YES	MAYBE	NO
	a. Is every symbol defined?	YES	MAYBE	NO
	b. Is the same symbol only used for equal quantities?	YES	MAYBE	NO
	c. Is the equal sign used correctly?	YES	MAYBE	NO
5.	Is the English correct?	YES	MAYBE	NO
	a. Are the sentences complete?	YES	MAYBE	NO
	b. Do all pronouns have a clear antecedent?	YES	MAYBE	NO
	c. Is the spelling correct?	YES	MAYBE	NO
6.	Is the presentation or format neat and clear?	YES	MAYBE	NO

Explain all MAYBE or NO responses. Refer to specific line numbers.
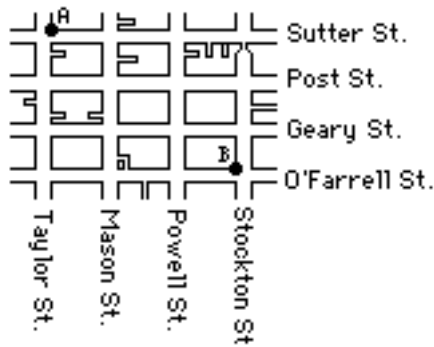
Problem Solving Strategy: Simplify the Problem

It may be useful to consider, describe, or list the objects which satisfy only part of the condition imposed on the unknown by the given problem.

Problems

1. What single three-dimensional shape will go through all three of the holes?

2. Compute $111,111,111^2$. Do not use a calculator or computer.

3. Melissa lives at the YWCA (point A) and works at Macy's (point B) as shown in the map below. She usually walks to work. How many different routes can Melissa take if she doesn't backtrack - that is, if she always travels toward her destination?

4. In how many zeros does 1,000,000! (one million factorial) end?

Two Minute Reflection

Directions: Reflect on the simplify the problem strategy and write a few sentences about what you want to remember from this problem solving experience.

Student #5

Before today I thought simplifying was factoring something. Now I feel like I've learned that simplifying is not just factoring, but also doing only a part of a problem or reducing the size of the numbers involved in the problem.

Student #6

Something I have learned today is how to apply Pascal's Triangle to a real life problem. I also learned that 3 minds are better than one.

Mathematical Writing Activity:

Watch Those Pronouns

When writing mathematical explanations, students often use pronouns instead of more accurate mathematical terminology. As a result, the writing is unclear. When proofreading, pay close attention to the use of any pronouns: *it, one, this, that, these, those, they*. If it is not obvious what the pronoun refers to, replace the pronoun with a mathematical term or phrase.

Directions: In the writing samples below, underline each occurrence of a pronoun. Then re-write the solution, replacing pronouns as needed to increase clarity. Make any other improvements to the writing as well.

1. Problem: Find the slope of the line:

$$3x - 7y + 5 = 0.$$

Solution: To find it we solve it for y:

$$3x - \quad 7y + 5 = 0$$
$$7y \quad = 3x + 5$$
$$y \quad = \tfrac{3}{7}x + \tfrac{5}{7}$$

So it gives us m = $\tfrac{3}{7}$.

Fall 92 Student #1 (On Problem Solving)

The thing I gained the most from this class is my problem solving abilities. Before this class, if a problem <u>seemed</u> impossible, I would probably not have attempted it. Now when I read a problem that seems very difficult or almost impossible, I feel like there must be some way to solve it, as long as I <u>try</u> different ways and <u>keep</u> trying and analyzing what I come up with, then I can solve it. Math writing and study skills were helpful in making my solutions clear and understandable.

Fall 92 Student #2 (On Writing Mathematics)

In this section we were asked to put into words the problems we solved in class as a Problem Solving exercise. ... There was never a math class before this for which the students were asked to express in words their solutions. This takes the procedure of solving problems into a new dimension: it allows the student to really examine and understand what is going on in the process of problem solving. If the write-ups were not up to par with what was expected, we were asked to re-write the work. This is a good way to know whether or not you're on the right track.

Developing Successful Math Majors:
A Two Semester Course Sequence

Student Manual and *Instructor's Manual*

by

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Additional Course Documentation

http://www.lacteonline.org/
Curriculum/ jackie/abstract.htm

Time prevents talking about…

Problem solving
The term paper
The portfolio
The reflective writing assignments

I have 10 handouts here
or
will gladly email the handouts and slides
if you email me

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