



# Math IS Everywhere!

*Robeson Community College  
Lumberton, NC  
May 16<sup>th</sup> & 17<sup>th</sup>, 2011*



**Deann Leoni**

*Edmonds Community College — Lynnwood, WA*

*Mathematics Across the Community College Curriculum (MAC³)*

# Introductions – at your table

- Name
- College
- Discipline
- Questions:
  - a) Have ever taught an interdisciplinary course? If so, what?
  - b) What do you hope to get out of today's workshop?

# Who Is Here? Stand if you...

- Teach in Math & Sciences
- Teach in Social Sciences
- Teach in Health care / medical fields
- Teach in Humanities
- Teach in another field
- Teach at a college other than Robeson CC
- Have ever been to Washington State

# Today's Agenda (Day 1)

- 9:00 - 10:15      **Session I: Need for Quantitative Reasoning & an Overview of Math Across the Curriculum**
- 10:15 - 10:30      Break (Refreshments Served)
- 10:30 - 12:00      **Session II: Examples & Samples**
- 12:00 - 1:15      Lunch on your own
- 1:15 - 2:30      **Session III: Brainstorming & Resources**
- 2:30 - 2:45      Break (Refreshments Served)
- 2:45- 4:00      **Session IV: Designing your Assignment**
- 4:00 - 4:30      **Day One Reporting-Out and Feedback**



# Session I: The Need for Quantitative Reasoning

*Robeson Community College  
Lumberton, NC  
May 16<sup>th</sup> & 17<sup>th</sup>, 2011*



**Deann Leoni**

*Edmonds Community College — Lynnwood, WA*

*Mathematics Across the Community College Curriculum (MAC³)*

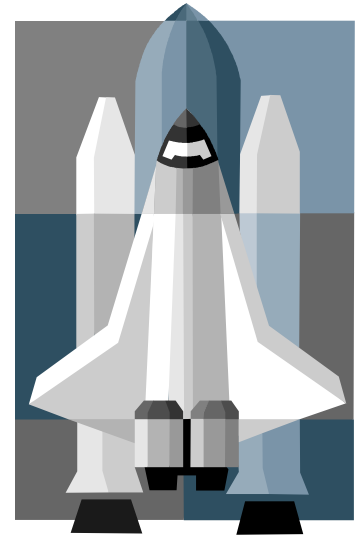
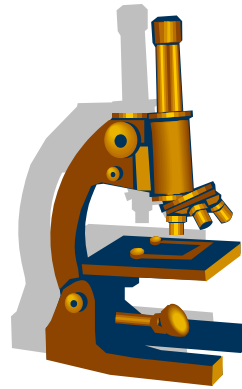
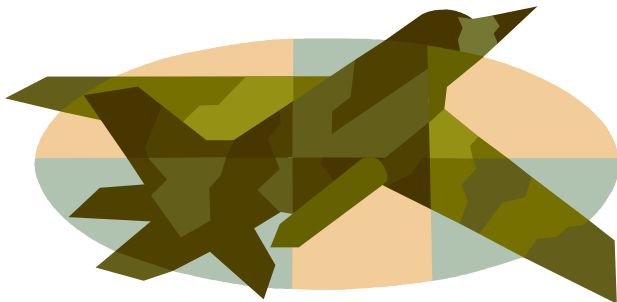
# Math is Everywhere???

- May need to expand your definition of math...
- May need to look at things differently...



# Science, Math, Technology

Science, math careers rank as best jobs during recession



# Math is also important for...

- The decisions students make in their personal and professional lives
- Students' understanding of the political and social issues that are part of citizenry
- The way people vote, and the policies they support.





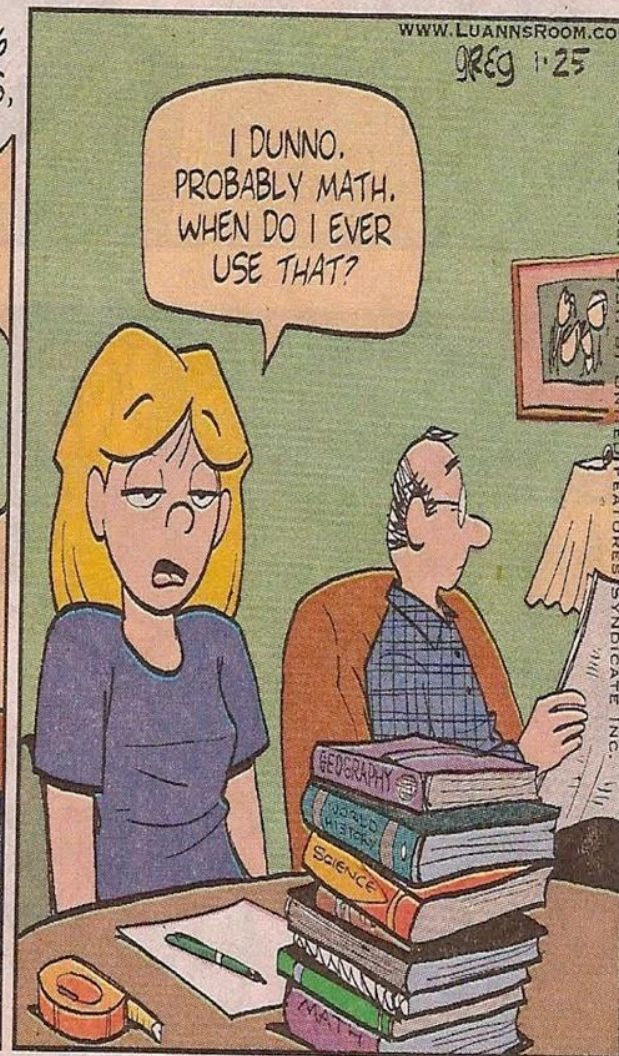
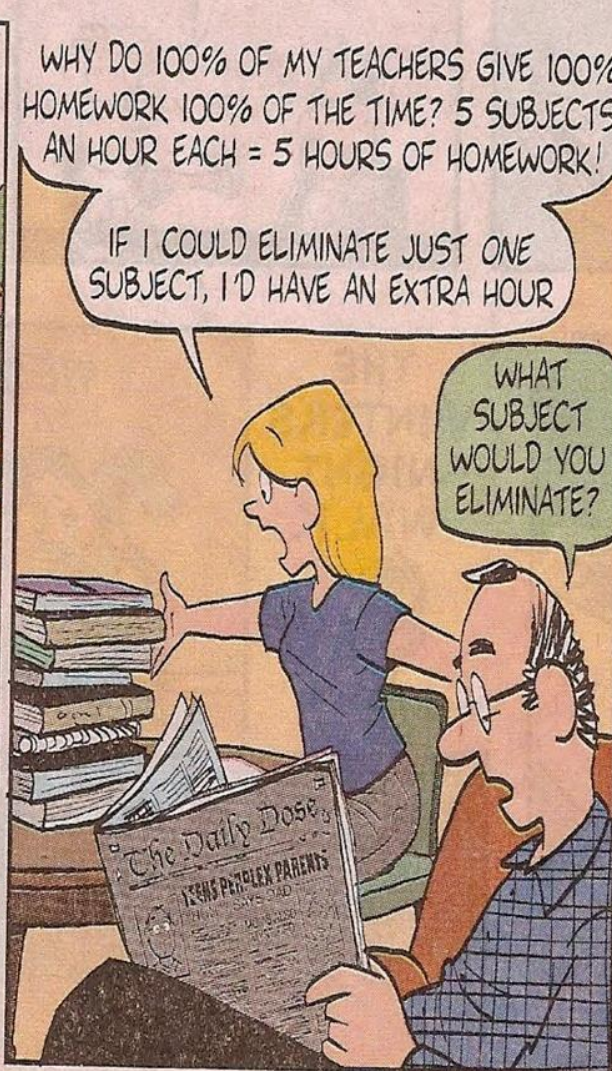
LOOK AT THIS! MY HOMEWORK PILE IS 21 INCHES HIGH! THAT'S 7 INCHES MORE THAN LAST YEAR - A 50% INCREASE!

WHY DO 100% OF MY TEACHERS GIVE 100% HOMEWORK 100% OF THE TIME? 5 SUBJECTS, AN HOUR EACH = 5 HOURS OF HOMEWORK!

IF I COULD ELIMINATE JUST ONE SUBJECT, I'D HAVE AN EXTRA HOUR

WHAT SUBJECT WOULD YOU ELIMINATE?

I DUNNO. PROBABLY MATH. WHEN DO I EVER USE THAT?





## *Mathematical Literacy* is defined as:

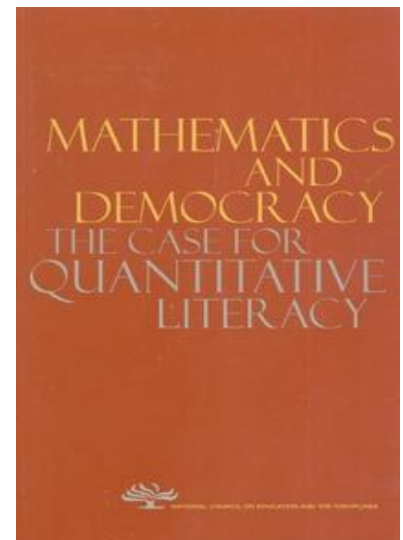
“An individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen.”

- *Programme for International Student Assessment (PISA)* Mathematics Framework

# What is Quantitative Literacy (QL)?

- “...quantitative literacy involves mathematics acting in the world. Typical numeracy challenges involve real data and uncertain procedures but requires primarily elementary mathematics.”

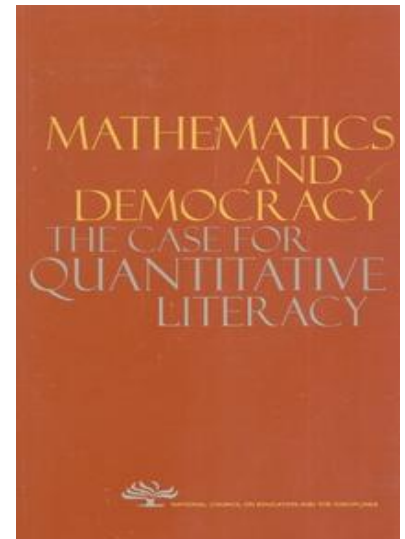
*-Mathematics and Democracy*



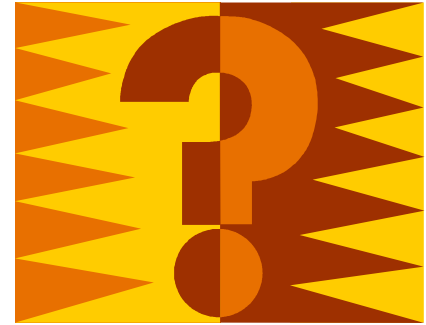
# What is Quantitative Literacy (QL)?

- “Numeracy is not the same as mathematics, nor is it an alternative to mathematics.”
- “Quantitative Literacy is more a habit of mind, an approach to problems that employs both statistics and mathematics.”

*-Mathematics and Democracy*



Vocabulary...



Math Across the Curriculum =

QL = Numeracy = Quantitative Reasoning



## Quiz 1: Which of the following do you think college students should be able to do?

- A) To decide to take the car loan at 10% with \$3000 cash back or the car loan at 6%
- B) To calculate the Payday Loan Lender rates for a cash advance
- C) To decide how to vote on the ballot measure on increasing the sales tax
- D) To solve  $x^3 - 3x^2 + 3x - 1 = 0$  by factoring

# RCC General Education Assessment Process



- “Each academic program at Robeson Community College [RCC] includes **a core of courses that outline the content, skills and learning outcomes** that students have in common, regardless of their academic program”
- The skills contained in this core of courses include critical thinking, writing, problem solving, **quantitative reasoning**, and reading comprehension. The competencies are assessed in this core of courses...
- RCC is cognizant of the need **to reinforce and assess these skills** throughout the student’s academic career... Therefore general education assessment will extend ...and include an **interdisciplinary approach** to the assessment of specified competencies.

## *The Essential Learning Outcomes (2011)*

Beginning in school, and continuing at successively higher levels across their college studies, students should prepare for twenty-first-century challenges by gaining:

- Intellectual and Practical Skills, including
  - Inquiry and analysis
  - Critical and creative thinking
  - Written and oral communication
  - **Quantitative literacy**
  - Information literacy
  - Teamwork and problem solving
- *Practiced extensively, **across the curriculum**, in the context of progressively more challenging problems, projects, and standards for performance*



# AMATYC Beyond Crossroads Curriculum and Program Development:

- “Quantitative literacy outcomes should be woven into every mathematics course and as many other college courses as possible.”



# Whose Responsibility?

- “Quantitative Literacy, the ability to use numbers and data analysis in everyday life, *is everybody's orphan*. Despite every person's need for QL, in the discipline-dominated K-16 education system in the United States, there is neither an academic home nor an administrative promoter for this critical competency.”
  - Bernard Madison  
in *Quantitative Literacy*



# Whose Responsibility?

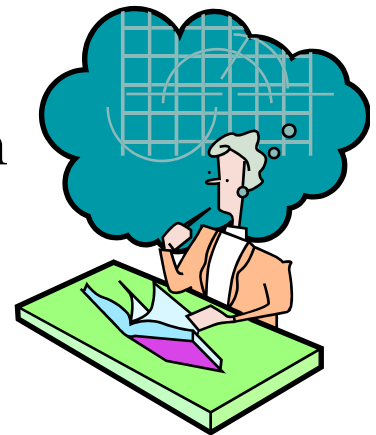
- “Quantitative literacy is more about habits of mind than specific mathematical content. **Therefore, the responsibility for developing quantitative literacy, like writing across the curriculum, is shared by the entire college faculty.** However, mathematics faculty should lead the quantitative literacy movement by helping to establish a set of outcomes expected of students in each program.”

- *AMATYC Beyond Crossroads*



# Mathematics Across the Curriculum

- MAC is one strategy to improve students' quantitative reasoning skills
- The in-process goal of MAC: to have students doing math / QL frequently and in many disciplines
- The end goal of MAC: to have graduates and employees with quantitative skills needed for today's technical, global economy



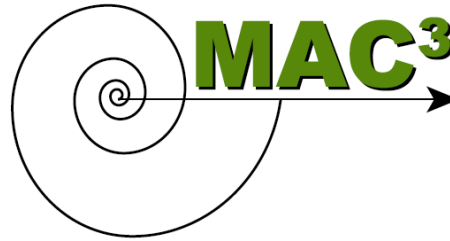
# A Bit of History

- Edmonds CC College-Wide Ability: Quantitative Skills (1997)
- NSF Grant: “Mathematics Across the Curriculum (MAC)” NSF CCLI Adaptation & Implementation (2000-2004)
- Department of Education Appropriations Grant: Mathematics Across the Curriculum (2005)
- NSF Grant: “Mathematics Across the Community College Curriculum” (MAC<sup>3</sup>) National Dissemination Grant (2005-2011\*)



# A Bit More History

- Grants & Projects
  - NSF Initiative: 1995 - Dartmouth College and others
- Books and Publications
  - 1997 – Why Numbers Count; 2001-Mathematics and Democracy)
- Professional Organizations:
  - Creation of National Numeracy Network (2004) and SIGMAA-QL (2004)
- Curricular Changes (?):
  - “Quantway” – Carnegie Foundation (2011+)



MAC<sup>3</sup> supports faculty of all disciplines in creating curriculum that enhances the mathematical or quantitative literacy dimensions in their courses.

## Quiz 2: Which of the following disciplines use mathematics or quantitative reasoning?

- A) Art History
- B) Art
- C) Anthropology
- D) English
- E) Nursing
- F) All of the above



## MAC<sup>3</sup> DISCIPLINES - [WWW.MAC3.AMATYC.ORG](http://WWW.MAC3.AMATYC.ORG)

Accounting  
Anthropology  
Art  
Art History  
Biology  
Business  
Career & Technical  
Campus-Wide Initiatives  
Chemistry  
Computer Information Systems  
Computer Science  
Economics  
Education  
English  
Environmental Science  
Ethnic Studies  
Ethnomathematics  
Geology

Health  
Health & Human Services  
History  
Humanities  
Labor Studies  
Mathematics  
Nursing  
Physics  
Policy Studies  
Political Science  
Psychology  
Reading  
Sociology  
Spanish  
Speech  
Special Education  
Statistics and Data Analysis  
Study Skills  
Urban Planning



## Session II: Examples & Samples

*Robeson Community College  
Lumberton, NC  
May 16<sup>th</sup> & 17<sup>th</sup>, 2011*



**Deann Leoni**

*Edmonds Community College — Lynnwood, WA*

*Mathematics Across the Community College Curriculum (MAC³)*

## **MAC<sup>3</sup> DISCIPLINES - [WWW.MAC3.AMATYC.ORG](http://WWW.MAC3.AMATYC.ORG)**

**Accounting**  
**Anthropology**  
**Art**  
**Art History**  
**Biology**  
**Business**  
**Career & Technical**  
**Campus-Wide Initiatives**  
**Chemistry**  
**Computer Information Systems**  
**Computer Science**  
**Economics**  
**Education**  
**English**  
**Environmental Science**  
**Ethnic Studies**  
**Ethnomathematics**  
**Geology**

**Health**  
**Health & Human Services**  
**History**  
**Humanities**  
**Labor Studies**  
**Mathematics**  
**Nursing**  
**Physics**  
**Policy Studies**  
**Political Science**  
**Psychology**  
**Reading**  
**Sociology**  
**Spanish**  
**Speech**  
**Special Education**  
**Statistics and Data Analysis**  
**Study Skills**  
**Urban Planning**

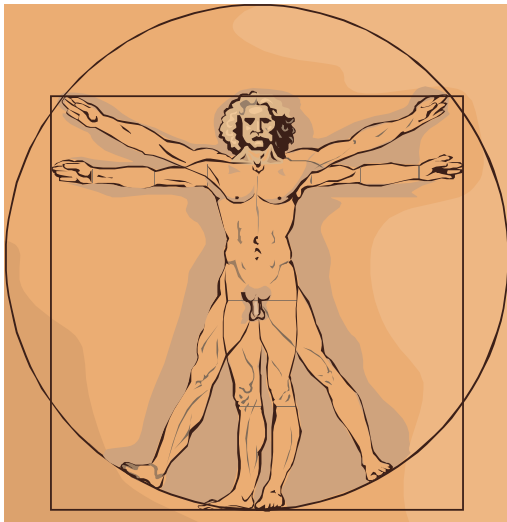
# Modes of Integration

- Projects within a Course
- Linked Assignment
- Learning Communities
- Service Learning Projects
- Department Wide Projects
- Institution Wide Projects

# Art History

## Edmonds Community College

- Added 2 credits of math to a 5 credit Art History course
  - No math prerequisite
  - Math discussed when applicable and required to be used in projects



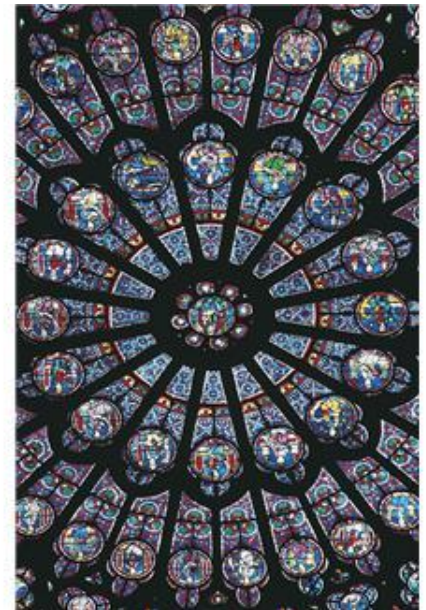
# Gothic Cathedrals



# Rose Window Project

## Objectives:

- To understand the construction and design of a Rose window in a Gothic cathedral.
- To understand the use of iconography in Rose windows.
- To understand the use of geometry, symmetry, and spirals used in Rose windows.





# Rose Window Project

Objectives:

- To design and construct a rose window using geometry, symmetry, and/or golden spirals.





# Nursing

## Miami Dade College

Developed modules and quizzes to help students with the math of medication and Dosage calculations

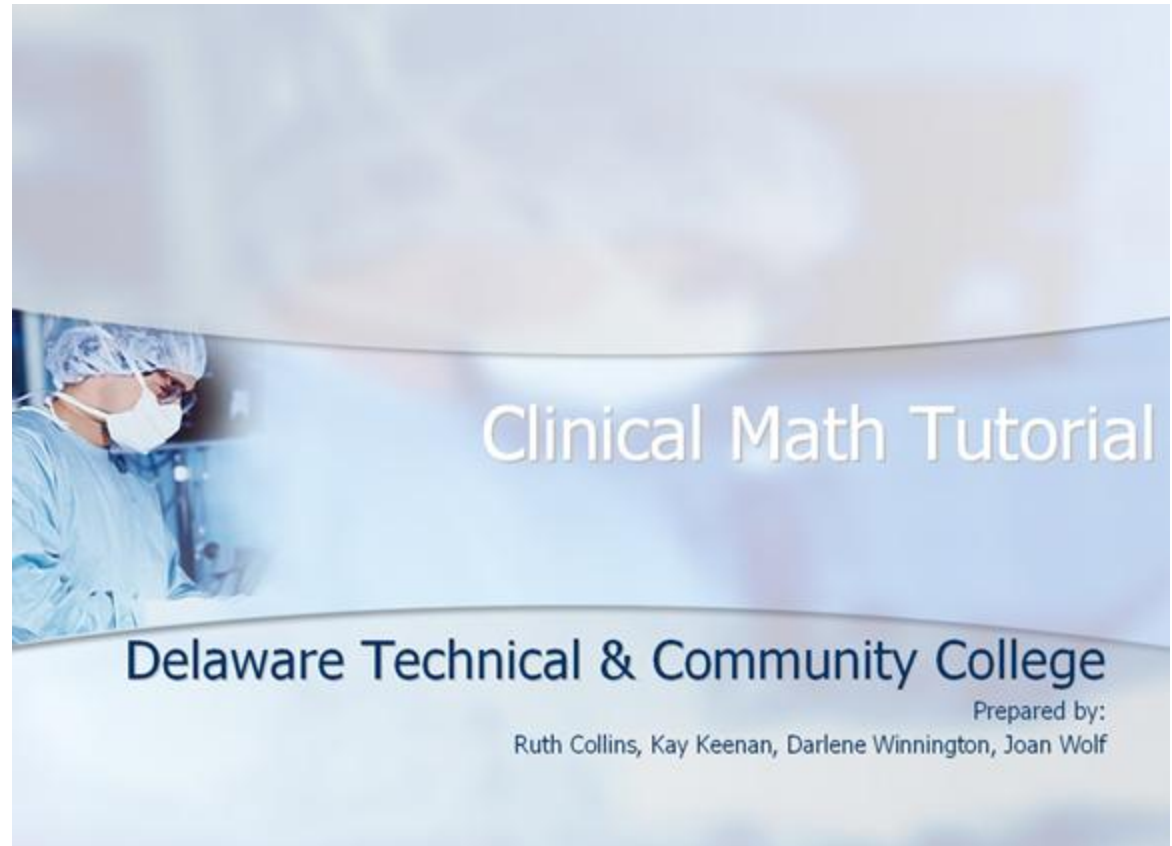


- Dimensional analysis
- Syringe Measurements
- Drugs in Powder Form
- Insulin Dosages
- IV Flow rates
- Intravenous Infusions
- Pediatric calculations

# Nursing

## Delaware Tech & Community College

- Made short videos of mathematical topics for nurses to be used online
- Goal for students is to “Gain or maintain competency in nursing-related math problems and calculations”



# Art: Ceramics

## Green River Community College

- Started as a non-credit integration when they developed ceramics projects in Geometry course for future teachers
  - Ceramic vase project
  - Tiles







# Art: Ceramics

## Green River Community College

- Combined Ceramics & 1  
CR Math – Fall 2006
  - Scavenger hunt
  - Measurement activities
  - **Ratio/proportion**
  - Symmetry patterns
  - Ethnomathematics
  - Unique surfaces





# Art: Ceramics

## Green River Community College

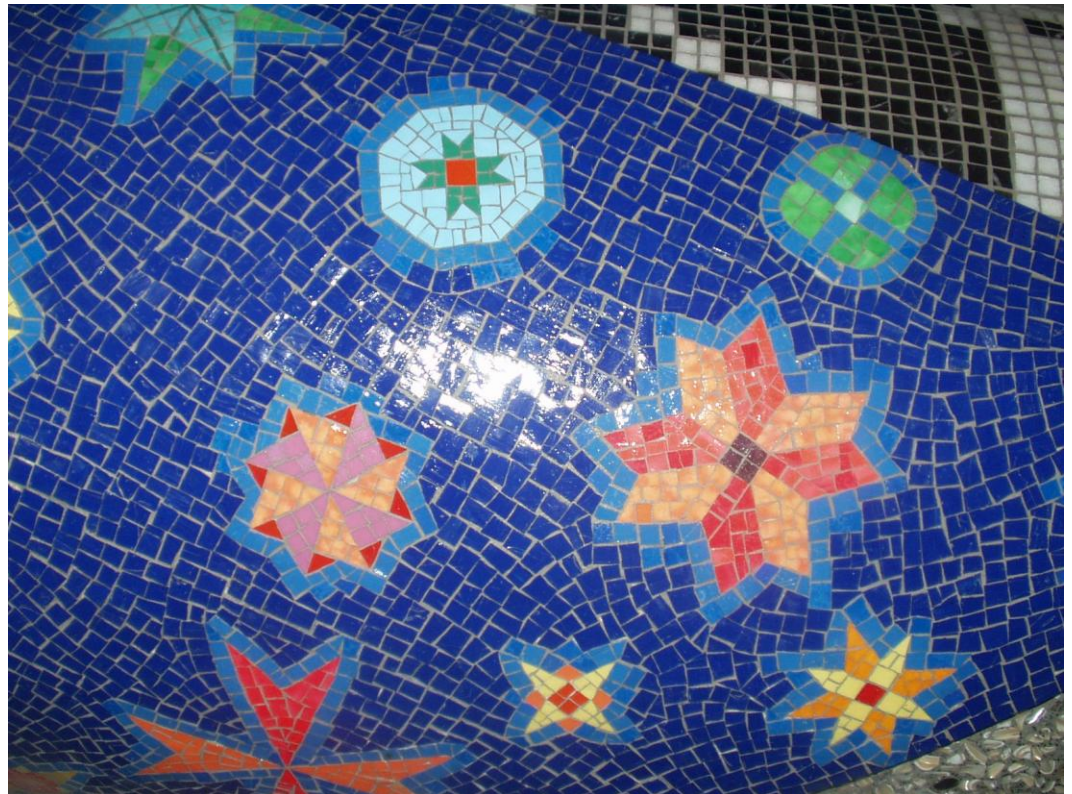
- Combined Ceramics & 1  
CR Math – Fall 2006
  - Scavenger hunt
  - Measurement activities
  - **Ratio/proportion**
  - Symmetry patterns
  - Ethnomathematics
  - Unique surfaces



# Art: Ceramics

## Green River Community College

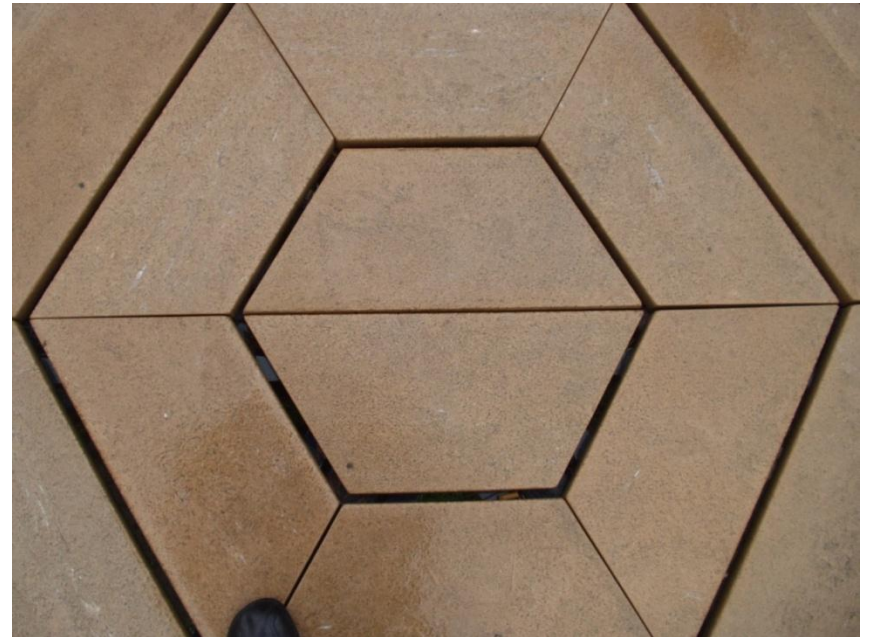
- Combined Ceramics & 1  
CR Math – Fall 2006
  - **Scavenger hunt**
  - Measurement activities
  - Ratio/proportion
  - Symmetry patterns
  - Ethnomathematics
  - Unique surfaces



# Art: Ceramics

## Green River Community College

- Combined Ceramics & 1  
CR Math – Fall 2006
  - **Scavenger hunt**
  - Measurement activities
  - Ratio/proportion
  - Symmetry patterns
  - Ethnomathematics
  - Unique surfaces





# Spokane Falls Community College



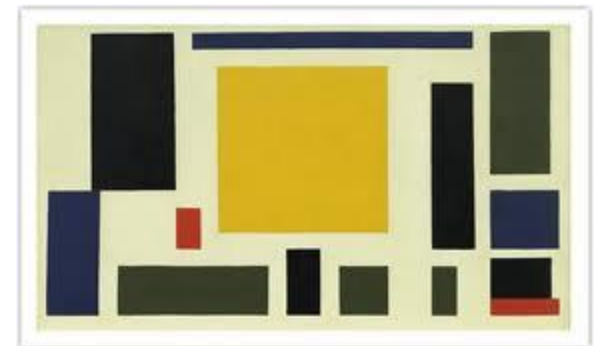
# Art

## Spokane Falls Community College

- Design project in Art Class
  - Focus on composition, color harmonies, and geometric shapes



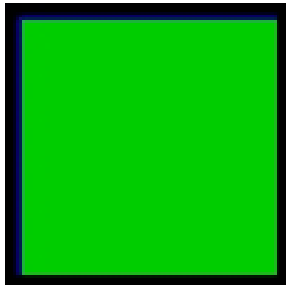
Theo van Doesburg



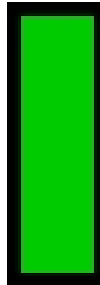
# Art

## Spokane Falls Community College

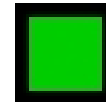
- Design project in Art Class
  - Used (cleverly-disguised) **Algebra Tiles**



Lg Square =  $x^2$



Rectangle =  $x$



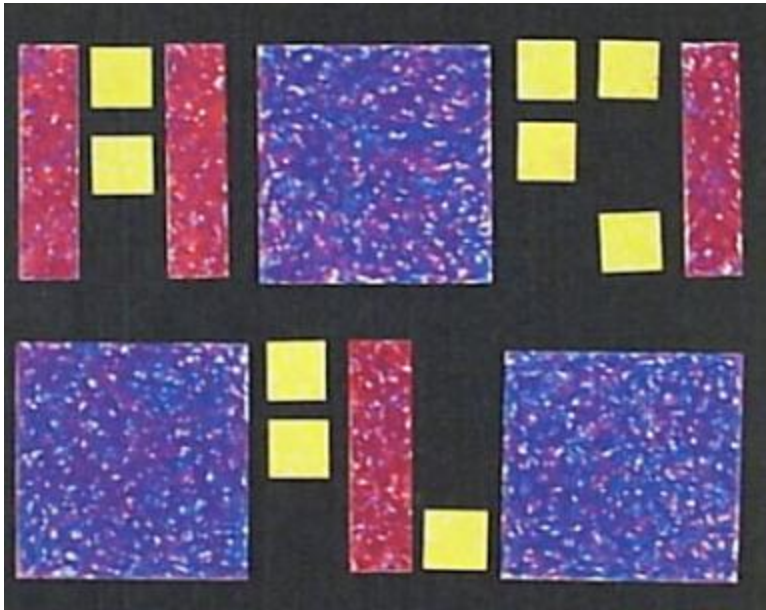
Sm Square = 1

# Art

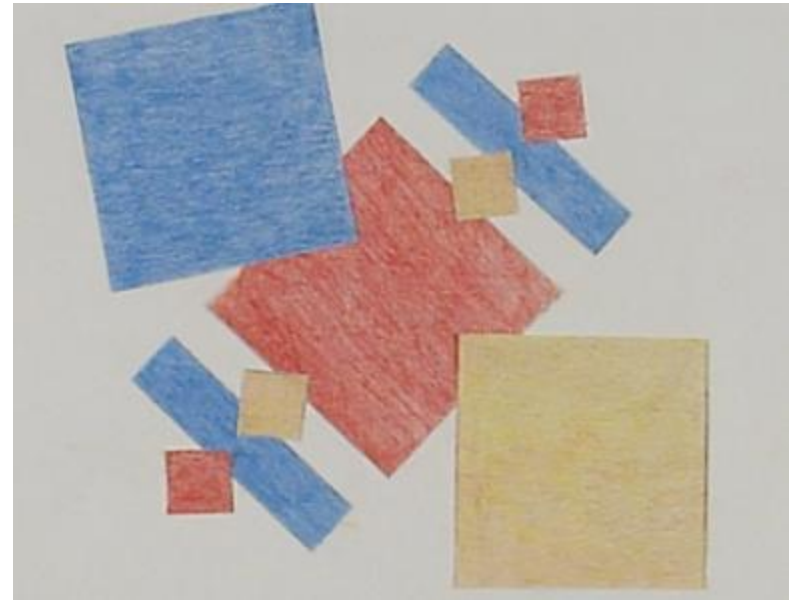
## Spokane Falls Community College

- Students drew sketches, painted shapes, then built designs
- Only at end did she have them translate to algebraic expressions

# Art - Student Work



$$3x^2 + 4x + 9$$



$$3x^2 + 2x + 4$$



# Other Disciplines

## Spokane Falls Community College

- Chemistry, Computer Science, Engineering, English, Gerontology, Physics, and Saddle Making



# Biology with Math-Aid

- Combined Biology 201 (5-credits) with Topics in Math (2-credits).
  - Added one hour of math “lecture” for four weeks
  - Knowledge of math content used in assignments and labs

# Biology with Math-Aid

<b>Math topic</b>	<b>Biology examples</b>
Graphing	Photosynthesis Enzymatic reactions
Units & Scientific Notation	liter, ml, $\mu$ l, meter, mm, $\mu$ m ...
Logarithms & exponential functions	pH, electrophoresis, bacterial growth
Probability & Genetics	Mendelian genetics
"DNA math"	restriction maps, electrophoresis



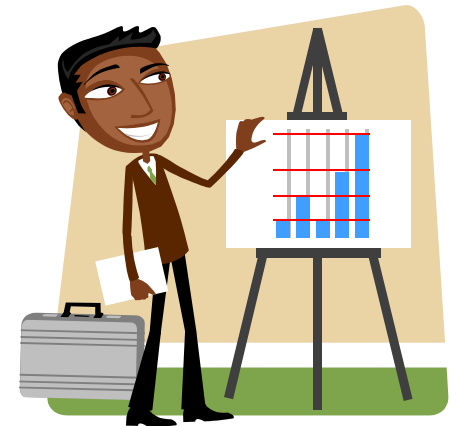
# *Biology with Math-Aid*

- Math Instructor feedback
  - The math instructor better understood which mathematical skills are used in biology courses and how they are used.
  - The math instructor can now incorporate more appropriate examples into the mathematical courses that are prerequisites for biology.



# Health

- Lessons on Survey Design, Graphing, & Statistics
  - Learn to effectively assess the statistics in current media by developing critical thinking skills with the data.
  - Learn how to design & administer valid surveys.
  - Learn how to perform simple statistical analyses. Data used will be on drugs, alcohol & sexual health for potential adolescent behavior modification.
  - Learn how to make good graphs.



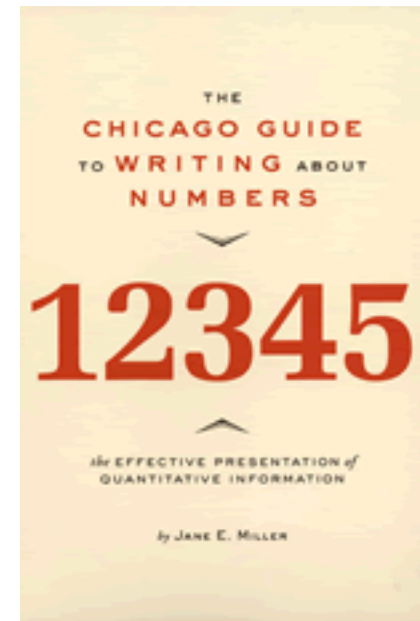
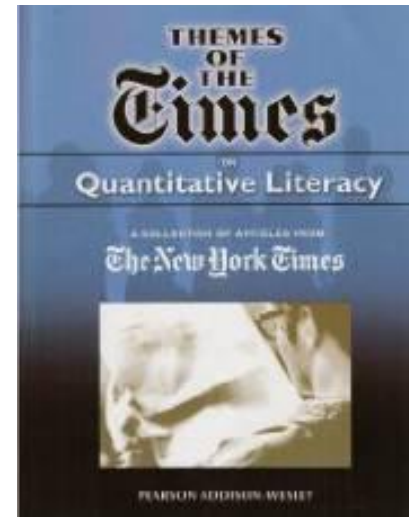
# Spanish

- Doing math (basic math or algebra) in Spanish
  - Learn words for numbers without sequence
- Completing quantitative projects in Spanish class (with directions given in Spanish)
  - Converting units (metric)
  - Geographically-appropriate business project
- Comparing math structure with language structure
  - Similarities in rules



# English

- Many MAC courses have combined English and Math.
- Writing about numbers is not easy.



# Many Journalists get it wrong...

## Too much candy could lead to prison

LONDON, England – AP: 9/30/09

- The reported statistic:

*“Of children who ate candies daily at age ten, 69% were arrested for violent offenses by age 34.”*

- The real statistic:

*“69% of those arrested for violent offenses by age 34 ate candies daily at age ten.”*



# Algebra the Write Way

## ○ Coordinated studies course – integrated course

- 5 CR *Elementary Algebra* course & 5 CR *Intro to Essay Writing* course

## ● Common ground/focus areas:

- Writing to explain the mathematical algorithms and deepen understanding of concepts
- Readings related to mathematics / Quantitative Reasoning

## ● Key Integrated Parts of the Course

- Math Homework writing questions
- Journal (writing & math prompts, reading responses)
- Essays

# *Algebra the Write Way*

## Essay Assignments

- Math autobiography (in-class)
- **Essay #1:** Argument for or against more emphasis on quantitative literacy in schools
- **Essay #2:** Argument for or against Walmart (using quantitative support)
- **Essay #3:** Explanatory Thesis on the topic of Ethnomath

# Anthropology

# Edmonds Community College

- ## 1) Ethnomathematics module

- ## 2) Coordinated Studies with Biology

- ### 3) Service Learning Project





# Anthropology –

## MAC<sup>3</sup> and Service Learning

### Edmonds Community College

- Students monitoring the status of a restoration project at Portage Creek Wildlife Area



# Anthropology –

## MAC<sup>3</sup> and Service Learning

### Edmonds Community College



# Anthropology –

## MAC<sup>3</sup> and Service Learning

### Edmonds Community College

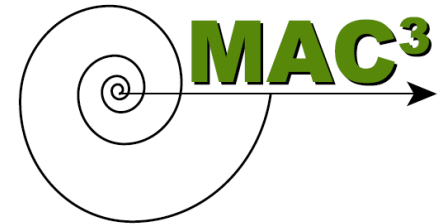


# Themed Learning involving Math/QL

- Sustainability and Mathematics Across the Curriculum
- Integrative Learning Community - “Water”



# Explore More on Your Own -- Web Links with Examples



1. **MAC³ Projects and Courses**

<http://www.mac3.amatyc.org/projects.htm>

2. **Dartmouth College Electronic Bookshelf**

<http://www.math.dartmouth.edu/~mqed/index.html>

3. **Statistical Literacy**

<http://www.statlit.org/>

4. **MAC Project at Middlesex CC**

<http://www.middlesex.mass.edu/math/mac.asp>

5. **Social Science Data Analysis Network**

<http://www.ssdan.net/chip/exercises.shtml>

# Team Building Activity

## Marshmallow Towers

Directions: Make the tallest, freestanding tower with the supplies you are given.

Time limit: 7 minutes

*Prizes awarded to the winning team members.*

# Work Time

- Brainstorming Worksheet
- Begin working on an activity (outline, outcomes, ...)
- Report back to the large group at 4:00
  - Names, disciplines, school, and #5 (summary description of your project)

# Other Web Sites

- The Math You Need When You Need It:
  - <http://serc.carleton.edu/mathyouneed/>
- Data from US and other countries:
  - [www.data.gov](http://www.data.gov)



# Share with the large group

- Have a representative from your team report out
    - Your names and school
    - What subject(s)
    - Basic overview of your project (module/activity)
    - Questions remaining or resources needed
- (Maximum of 2-min per team)



# Day 1 Reporting Out & Feedback

*Robeson Community College  
Lumberton, NC  
May 16<sup>th</sup> & 17<sup>th</sup>, 2011*



**Deann Leoni**

*Edmonds Community College — Lynnwood, WA*

*Mathematics Across the Community College Curriculum (MAC³)*

# Share with the large group

- Have a representative from your team report out
    - Your names and school
    - What subject(s)
    - Basic overview of your project (module/activity)
    - Questions remaining or resources needed
- (Maximum of 2-min per team)

# Feedback Cards

- On the 4x6 card, answer the following:
  1. What did you learn today that you will use or apply in your MAC project?
  2. What do you still need to know in order to implement your MAC project?
  3. What questions do you still have about today's topics?
  4. Is there a topic we didn't cover?