MATHEMATICS ACROSS THE CURRICULUM – A STRATEGY FOR QUANTITATIVE LITERACY

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OUR BACKGROUND IN MATH ACROSS THE CURRICULUM


- NSF National Dissemination Grant (2005-2009)

AMATYC
Complete the following statement: (think, pair, share...)

- A quantitatively literate student should be able to . . .
PHILOSOPHY OF MOUNT Si HIGH SCHOOL

- We also recognize the importance of a variety of learning experiences. Fostered by a diverse, integrated curriculum, we strive to enable students to identify and realize their potential, to celebrate individual differences, to develop skills and motivation for lifelong learning, and to be knowledgeable, responsible and productive citizens.
Mathematics Department Mission Statement
“Our goal is to create a mathematically literate student.”
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, 2000)
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.”

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
- **School-wide Mission Statement**
  Our goal is to create a quantitatively literate student.
“The capacity to deal effectively with quantitative aspects of life is referred to by many different names, among them quantitative literacy, numeracy, mathematical literacy, quantitative reasoning, or sometimes just plain ‘mathematics’.”

*Mathematics and Democracy*
WHOM SAYS WE NEED QL?

- NCTM Standards:
  - Connections Standard
    - “Recognize and apply mathematics in contexts outside of mathematics.”

- EALRs & GLEs:
  - “The student understands how mathematical ideas connect within mathematics, to other subject areas, and to real-world situations.”

- Mt. Si HS Math School Improvement Plan
  - Rational: “Math WASL results show need for improvement; Demonstrated need to enhance math comprehension of all students;”
  - Activity: “…assist all departments in intentionally integrating math concepts into their existing lesson plans.”
EXAMPLES OF MATH ACROSS THE CURRICULUM PROJECTS
Accounting  Health
Anthropology  Health & Human Services
Art  History
Art  Humanities
History
Career & Technical  Labor Studies
Campus-Wide Initiatives  Mathematics
Chemistry  Nursing
Computer Information Systems  Physics
Computer Science  Policy Studies
Economics  Political Science
Education  Psychology
English  Reading
Ethnic Studies  Sociology
Ethnomathematics  Spanish
Geology  Speech
Environmental Science  Special Education
Ethnology  Statistics and Data Analysis
Geology  Study Skills
Geography  Urban Planning
WHAT CAN MAC LOOK LIKE?

**Modes of Integration:**
- Projects within a Course
- Linked Assignments
- Entire Courses
- Learning Communities
- Service Learning Projects
- Department Wide Projects
- Institution Wide Projects
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WHAT CAN MAC LOOK LIKE?

- **Examples of projects:**
  - Art – Design or Ceramics
  - English - Composition or Journalism
  - Sciences – Chemistry or Biology
  - Vocational/Technical – Construction Tech
  - PE/Health - Health
  - Foreign Language - Spanish
  - Social Studies- Ethnomathematics
ART (DESIGN) COURSE

- Project in *Two-Dimensional Design* course
- 5 CR Art course – no math “credit”
- Math instructor guest lectured on Regular Polygons & Tessellations

- Instructor found that incorporation of geometric figures gave students form and structure
EXAMPLES OF STUDENT WORK – ART DESIGN COURSE
ART: CERAMICS

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

- Combined Ceramics & 1 CR Math
  - Measurement activities
  - Ratio/proportion
  - Scavenger hunt
  - Symmetry patterns
  - Ethnomathematics
  - Unique surfaces
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OTHER IDEAS FOR FINE ARTS

- Photography – dimensions, ratios
- Drawing – perspective, ratios, constructions
Math and Writing
Beginning Algebra/English 101

- Comparison/Contrast papers: students performed a taste test between two products
- Concept Maps
- Summary Statements
- Boolean Logic for library searches
Math and Writing
Beginning Algebra/Reading

- Pre-reading assignments for technical reading
- Concept mapping
- Application Problem/Poem assignments
- Reading for Content
BIOLOGY WITH MATH-AID

- Combined Biology 201 (5-credits) with Topics in Math (2-credits).
  - Knowledge of math content used in assignments and labs
# BIOLOGY WITH MATH-AID

<table>
<thead>
<tr>
<th>Math topic</th>
<th>Biology examples</th>
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<tbody>
<tr>
<td>Graphing</td>
<td>Photosynthesis</td>
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<td>Enzymatic reactions</td>
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<td>Logarithms &amp; exponential functions</td>
<td>pH, electrophoresis, bacterial growth</td>
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<td>Probability &amp; Genetics</td>
<td>Mendelian genetics</td>
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<tr>
<td>&quot;DNA math&quot;</td>
<td>restriction maps, electrophoresis</td>
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Vocational / Technical Courses

- Melanie Breitbach & Greg Meyers
- Construction Tech and Math
HEALTH
(MOUNTLAKE TERRACE HIGH SCHOOL)

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

- Doing math (arithmetic 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
ETHNOMATHEMATICS

- Buildings
- Land Measurement
- Agriculture
ETHNOMATHEMATICS

- Quipu project
QUESTIONS FOR BRAINSTORMING – Yellow WORKSHEET

- Break into groups (by department) with math “mentor”
QUESTIONS FOR BRAINSTORMING - WORKSHEET

1. First, brainstorm about the quantitative aspects or elements of your course/discipline. If needed, consider the following questions about the classes you teach. What can you quantify? What could you represent graphically or visually? What can you measure? List as many as you can think of.
QUESTIONS FOR BRAINSTORMING - WORKSHEET

2. From the list you created in #1, choose one specific quantitative aspect on which you can create an assignment to implement in at least one course you teach this Fall semester. Your assignment might add new content or it may simply deepen the quantitative reasoning you already teach.
3. Articulate the learning objective(s) you have for your students that you will address with this lesson or assignment you made in #2.

4. Referring back to the list you made in #1, what other lesson or assignment(s) could you create to implement during Spring semester that will deepen or extend the quantitative reasoning elements?

5. In one or two sentences write a description of your project. This information will be shared with the large group during the reporting out time.
Report Out

- Please have one person from your group give a 1-2 sentence summary of your project.
Return to Groups – do pink worksheet

- Include a timeline or dates with your Tasks listed in question #1
- Note any challenges or obstacles that arise in your group discussions – we will talk about these later.
WEB LINKS to Resources

- MAC³ Projects and Courses

- Dartmouth College Electronic Bookshelf
  - http://www.math.dartmouth.edu/~mqed/index.html

- Statistical Literacy
  - http://www.statlit.org/

- Social Science Data Analysis Network
  - http://www.ssdan.net/chip/exercises.shtml

- Mathematical Association of America SIGMAA-QL
  - http://www.maa.org/QL/

- National Numeracy Network
  - http://serc.carleton.edu/nnn/
THANK YOU!
YOU CAN CONTACT US AT:

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