SIGMAA-QL NEWSLETTER OCTOBER 2008

A BRIEF SURVEY OF MATHEMATICAL LITERACY

MICHEAL FISH, UNIVERSITY OF WISCONSIN–MADISON

Classical interpretations of mathematical literacy have framed the discussion around the mathematical knowledge students need to know in order to understand arithmetic properties and to apply number sense (National Center for Education Statistics, 1993). This interpretation meant that students would gain mathematical knowledge needed for basic arithmetic operations (for example, properties of addition and subtraction) and skills relevant for essential, basic social interactions, such as having sufficient fluency with numbers to fill out a bank deposit slip or calculate a tip after a meal.

The transition to an early modern definition of mathematical literacy incorporated the classical definition and introduced an international perspective to the understanding of the topic, and large-scale international studies in the 1990s sought ways to assess international students' mathematical knowledge under this definition. For example, surveys such as the TIMSS 1995 identified mathematical literacy as competencies in number sense (including fractions and percentages as well as proportionality); algebraic sense; data representation; measurement and estimation; and reasoning and social utility. These surveys also emphasized the types of understanding students need to fully participate in today's technology-dependent, information-rich society (Mullis, et al., 1998).

Entering the 21st century, social issues and globalization themes encouraged mathematics education researchers to question the value of the mathematics that students were learning, and competing notions of mathematical literacy stressed different understandings. Initial new-modern definitions of mathematical literacy were fragmented and proposed different knowledge content. For example, researchers could not agree on whether mathematical literacy should be oriented toward interpreting workplace encounters (Forman & Steen, 1994; Skovsmose, 1994) or

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COLLABORATIONS IN QL

SEMRA KILIC-BAHI AND BEN STEELE, COLBY-SAWYER COLLEGE

Three interrelated QL events hosted by Colby-Sawyer College brought around 50 educators from 14 different states to explore the current research and practices related to issues around students' quantitative literacy skills. The events were supported by National Numeracy Network (NNN), SIGMAA-QL, Carleton College's Quantitative Inquiry, Reasoning, and Knowledge (QUirk) Initiative and Colby-Sawyer College.

The first day of the three-day events was the 4th annual NNN meeting, held on May 15. It featured presentations given by Milo Schield of Augsburg College about The Keck Statistical Literacy project, Daniel Coyle of LexisNexis about "Statistical DataSets" as a teaching tool, NNN president Corri Taylor of Wellesley College about Wikipedia entry on Numeracy, Eric Gaze of Alfred University about the common trends in Literacy and Quantitative Literacy, Glenn Sproul of Johnson State College about developing a QL program, and Nathan Grawe of Carleton College about successful grant-writing tips in support of QL programs. The evening reception was followed by the keynote address entitled "Storyboarding With Data Activity: Using Quantitative Reading to Teach Research Writing" by Mya Poe, Director of Technical Communication at MIT.

The second day's event, "Writing with Numbers" workshop was sponsored by Carleton College's Quantitative Inquiry, Reasoning, and Knowledge (QUirk) initiative. The participants worked on designing writing assignments which aim at engaging students to communicate with numbers. More than twenty new assignments were developed by participants.

The last day's event, the 12th annual Northeast Consortium on Quantitative Literacy (NECQL) conference

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LETTER FROM THE CHAIR

KIMBERLY VINCENT, WASHINGTON STATE UNIVERSITY

First I would like to thank Maura Mast for serving two years as Chair of SIGMAA-QL. When the chair elect in 2006 stepped down Maura agreed to serve another term. This was great, for I was new to the executive committee and had not had an opportunity to learn the roles I would take on. It was very generous of Maura to serve an extra year. As the new year begins SIGMAA-QL will be under the leadership of Cinnamon Hillyard, as the chair. I know Cinnamon through our involvement on several different projects in Washington and she will have insight and the leadership needed to continue the good work done under the guidance of previous SIGMAA-QL chairs.

The math wars are gaining attention around the country. Parents are demanding that their students do well in mathematics. The National Math Panel made recommendations for what we should focus on to improve K-12 mathematics education and mathematics educational research. Law makers recognize what educators did years ago; Title II is not working to improve mathematics knowledge and needs a major overhaul. Despite all the attention, there is no consensus nationally on how to teach mathematics nor what is the most important mathematics to teach. One contentious topic is the inclusion of statistics in high school curriculum or in mathematics departments at the university level. As many of you have experienced, college students frequently can compute mean, median and mode but cannot discuss what is typical about a set of data and what that tells them about the data or context. Understanding or not understanding quantitative information is at the heart of uses and abuses of statistics.

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Training Tutors in the Quantitative Skills Center

Nicole Hoover, UW Bothell

At the University of Washington Bothell (UWB), we have one center aimed at supporting students and faculty with quantitative reasoning—the Quantitative Skills Center (QSC). Our faculty value integrating QR across the curriculum, so many courses that would not traditionally be quantitative, have QR built into them. The QSC supports all of the programs and courses with any quantitative aspect in the curriculum. Because there is such a wide range of topics and a wide range of students we see coming through our door, the task of training tutors to work with these students is not a small one!

Almost all of the tutors in the QSC are current UWB students coming frequently out of business, computing, policy studies and our lower division program. I do not expect every tutor to be able to work with students from every course, though I do train them and encourage them to work outside of their own program of study. It is not uncommon for a business tutor to be working with a nursing student, or a Computing and Software Systems tutor to be working with an education student.

Because ours is a commuter campus, it is often difficult to get the tutors to come back to campus outside of their regular school and work schedules, so I have had to become creative and flexible in the ways I train them. Every quarter we start out with a 3 or 4-hour training for new and returning tutors. The new tutors go through a short, general orientation of the center and what their responsibilities are. Other than that, I like to train all of the tutors together—even if it's review for some. A Tutor Handbook, specifically written for our staff, is distributed prior to this training, and I expect the tutors to have read through it before the training. Together we review some of the guidelines and policies, and spend much of the remaining time focusing on tutoring methods. We brainstorm about what would make an ideal tutoring session, and we discuss strategies for how to achieve this idea. We also brainstorm about what types of things can go wrong and how to deal with these more challenging sessions. After this discussion, we try these strategies out by doing some role playing. I try to make these training sessions as tutor-centered as possible

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Training Tutors Well Helps to Promote Quantitative Literacy

Josephine Rodriguez, Western New England College

One of the resources that we have, at Western New England College, to promote quantitative literacy in our students is the individual help available through peer tutors. When students are struggling with quantitative reasoning and skills, sometimes working one-on-one with someone willing to patiently help them identify their conceptual difficulties and understand the material can make all of the difference in the world. A person who never fully grasped a fundamental topic like fractions, percents or rates of change sometimes has an "Ah-Hah!" experience during tutoring sessions. The insight gained through this kind of epiphany can dramatically improve an individual's level of understanding and quantitative literacy for life.

With this in mind, QL Centers, Academic Support Centers, Math Departments and Math Centers across the country hire students to provide peer tutoring in mathematics classes and QL courses. However, there is a lot more that goes into being a good tutor than simply having been able to get an "A" in a certain course. Understanding people's learning styles, the importance of the interpersonal dynamics between the tutor and the tutee, and how to role model good problem solving skills are all key factors in successful tutoring.

Sometimes, students simply learn to become a tutor through a "baptism by fire" approach. Alternatively, as professionals in the field, we may be called upon to train new math tutors. The following list provides a brief description of some of the important things math tutors should know. The tips may seem natural to those who teach math everyday, but they are not always as obvious to brand new tutors, who may be somewhat apprehensive about what is entailed in this job. I have devised a "Top Ten List" to give out to all new peer tutors as part of the Tutor Training Session for those who work in the Math Center at Western New England College. This list has helpful tips for those who are going to specialize in tutoring math or QL courses, and provides a wonderful source of potential topics for discussion during the training workshop.

Top Ten Tips for Tutoring Math

1) Try to pinpoint what concepts the student is having a difficult time understanding.
2) Help the student work through some math problems.
3) Explain things in various ways, keeping in mind different learning styles.
4) Role model good problem solving skills and good study skills.
5) Understand that it is good to wait for a response after asking a student a question.
6) Work up to generalizations and concepts after doing some motivating problems.
7) Understand other issues that might be at play, like learning disabilities or math anxiety.
8) Help the student build confidence in his/her ability to do the work.
9) Realize that math tutoring has its limits. (Turn to your supervisor if you need help.)
10) Keep it simple and straightforward.

Credits

Kimberly Vincent and Maura Mast went out and collected the information for this Newsletter and sent the items to Aaron Montgomery who used Adobe's InDesign to lay out the material. The photographs were taken by Semra Kilic-Bahi and Corrine Taylor. The fonts used are 10 point Times for the regular text and 12 point Charlemagne for the titles. And, as always, I need to add just a little bit of text here to prevent empty space.

Events at 2009 JMM

Please join us at the Joint Math Meetings in Washintgon, D.C.

Our Annual Meeting for SIGMMA QL will be 5:45 – 7:15 pm Tuesday, January 6, 2009. We will conduct business and announce the new chair elect.

SIGMAA QL is also sponsoring a Contributed Paper Session Quantitative Literacy Across the Curriculum from 8:00 – 10:55 am Wednesday January 7, 2009.

EXCERPT FROM RATIOCINATION

ERIC GAZE, ALRED UNIVERSITY

A column devoted to ratios in all their guises: indices, coefficients, percentages, rates, scales, conversions, etc. Ratios are comparisons between the relative size of two quantities, a simple idea which surprisingly underlies much of the way we use numbers to communicate. The author welcomes any suggestions of ratios for use in this column. If your ratio is chosen (first suggestion received for that ratio) you will be sent a complimentary Alfred University t-shirt!

Numb: In 2005 there were 62 million people under 15 and 36 million people 65 and over in the US.

Number: In 2005 the number of people under 15 (62 million) and 65 and over (36 million) in the US was 33% of the total population.

Num-best: In 2005 the number of people under 15 (62 million) and 65 and over (36 million) in the US was 33% of the total population, and this is expected to grow to 41% by 2050. In contrast 49% of Niger's population in 2005 were "dependents", and this is expected to drop to 37% by 2050…

Sounds like something out of Freakonomics I know, but this idea actually comes from an excellent article, "The Risk Pool", in the August 28, 2006 New Yorker by Malcolm Gladwell. Pension plans, including Social Security, seem to be a no-brainer in terms of caring for retirees and their families. Employees pay a mandatory percentage of their salary into a pool matched by the company, which is invested by savvy professionals so that it compounds into a nice nest egg for the employee upon retirement. Excess gain from the pool is even used to cover disability claims and costs. So why are pension plans being phased out (except for the public sector) in favor of the mysterious sounding 401k plans?

The answer lies in dependency ratios, which compare the non-working age people (dependents) to those of working age in any given population; whether it be a company or a country. It might seem as though the number of dependents shouldn't matter since each employee is only collecting the money he or she deposited. Most pension plans, however, suffer from a fatal flaw: depending on how the plan was established, it owes money immediately to existing dependents. Known as a "pay-as-you-go" system, today's workers pay benefits for current dependents; and back in the 1950's the unions ensured the plans were very generous to existing employees and retirees who had paid in little to the pool.

In the case of Social Security, the Old Age and Survivors Trust Fund was well established in 1936, and had a balance of $267 million at the end of 1937 (US Fiscal Budget 2008). For twenty years this fund ran a surplus and the balance grew until 1958 when it paid out $8,041 million but only took in $7,825 million for a deficit of $281 million. Over the next twenty years the fund struggled to meet its growing obligations, with money coming in just barely covering money going out. The balance stopped growing and remained flat so that by 1980, the fund had an end of year balance of $24,578 million after paying out $100,615 million! In addition to the Old Age and Survivors Fund, three more funds were established: Disability in 1957, Hospital Insurance in 1967, and Supplementary Medical Insurance in 1967. By the 1990's all four of these funds were finally growing again, economically sound but demographically running out of time. The dependents were growing faster than the workers and the cost of care was skyrocketing. Thus the dependency ratio quantifies, in some sense, the "drag" on the financial well-being of that population due to supporting the children and retirees.

An example at this point will illustrate the devastating effect of dependents as captured in the dependency ratio:

GENERAL MOTORS' DEPENDENCY RATIOS (THE RISK POOL)

Year	Dependents	Employees
1962	1	11.6
2005	3.2	1

Back in 1962 each of those 11.6 workers was chipping in to cover the retirement of that lone pensioner, but 43 years later you have one exhausted employee trying to keep 3.2 retirees afloat. To make matters worse those 3.2 retirees are living a lot longer and paying a lot more for health care in 2005. There was just not enough money coming in, including interest gained on invested funds, to keep up with the massive outflow of cash for the pensions. I have heard that for each car GM sells, $1500 immediately goes to cover health care costs of employees. Now imagine a car company in a country with universal health care. That company can reduce its price by $1500 and still make the same profit as GM! What happens when a company can't keep up with its debt obligations? It goes bankrupt and those pensioners are left without a dime.

Excerpt from http://serc.carleton.edu/nnn/columns.html

North East Consortium for Quantitative Literacy, May 2008
From Left to Right: Corrine Taylor, President of NNN, Caren Diefenderfer, Chair Emeritus Σ-QL

CURRENT OFFICERS

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WE MUST PROMOTE QUANTITATIVE LITERACY

RICHARD MAHER, LOYOLA

Anyone who believes in the importance of quantitative literacy should realize that over the next twenty to thirty years we may see fewer and fewer college and university mathematics departments as we now know them. Back in the mid -1990's we had a precursor of what might be coming with the situation at the University of Rochester. As university administrators become more and more bottom line oriented, we may well find a large amount of mathematical instruction outsourced to departments that "use" mathematics in their courses or to other sources. To what extent, if any, this happens will depend not only on the quality of our major programs but also, perhaps to a larger extent, on our ability to meet the quantitative literacy needs of the students we serve and, to a somewhat lesser extent, of the public in general.

The public's perception of mathematics is mixed at best and probably tilts toward the negative. People who teach mathematics often hear comments like "I was never any good at mathematics." or "Math was always my hardest subject." We should not be surprised that singer Jimmy Buffett included a song entitled "Math Suks" in one of his albums. We also should not be surprised that back in the early 1990's a talking Barbie Doll was programmed to say, depending on the source, either "Math class is tough" or "I hate math. Then there are the television commercials. A couple of dozen times a year commercials will run on popular television programs that talk about a "complicated" problem that is much easier to deal with using the sponsor's product than it is to understand the mathematics going on in the background. Such negative stereotypes can strongly influence peoples' attitudes toward mathematics. They are only partially offset by the success of a television show like NUMB3RS – now beginning its fifth season – or by best-selling books entitled, appropriately, "Math Doesn't Suck." and "Kiss My Math." written by child actress turned adult actress Danica McKellar (Wonder Years, West Wing, various movies), who received a mathematics degree summa cum laude from UCLA. These books, aimed at sixth through ninth grade girls, do some mathematics but also try to alleviate this group's concerns about mathematics just as NUMB3RS tries to do the same thing for a more general audience.

Mathematics is misunderstood, feared, and even hated by many people. These feelings often continue from generation to generation, reinforced by our students' poor performance in the classroom, on the job, and on standardized tests, including TIMSS. It is little wonder that a recent Associated Press poll indicates that both parents and the public in general want schoolchildren to learn more about mathematics. Its results indicate that both groups realize that mathematics is important and that they do not understand as much about it as they would like. They also do not want the same fate to befall the next generation.

This whole situation indicates the unsettled state of mathematics education at the primary and secondary levels and in the community in general. The natural result is an ambivalent attitude toward mathematics, an attitude that will define the atmosphere in which we will operate in the near future. We have to develop ways to let people know – on an ongoing basis – that mathematics is a part of their everyday lives even though it may not appear that way all that often. In other words, we must help them become quantitatively literate. We must address the feeling that people in general need and want to understand more about mathematics and to overcome their fear of the subject. We must help people feel comfortable with quantitative data, no matter in what form the information appears. This will of necessity be a long-term effort requiring a whole lot more than having "Math Awareness Month" every April. It must involve our departments and our professional organizations, in particular the MAA, and, more particularly, our SIGMAA QL.

We face an entirely different situation when it comes to addressing the needs of students in our service courses. Strange as it may seem, what we have to do is convince our colleagues in other departments that we, with their input and cooperation, are the best source to provide quantitative literacy to their students. We must develop bonds with these departments to insure their support; we also have to provide courses that will make these bonds firm. We should not compromise our professional principles when structuring these courses but we must do our best to meet the quantitative literacy needs of our students in a way that best serves their needs.

When teaching quantitative literacy courses, we must not make the mistake of telling our students that they will use mathematics or statistics in their day-to-day professional and personal lives. For most students, this will not be the case. At the same time, this is not atypical of course requirements. For example, you would have a hard time finding practicing physicians who did not study a lot of biology and chemistry as undergraduates. But they don't spend much time each day dissecting frogs or analyzing mystery compounds. Future physicians need a background in biology and chemistry – and mathematics – to pursue their programs and be successful in their professions, even though they may not use this background on a regular basis. The same reasoning applies to the other students we encounter in our service courses.

If we are to make mathematics meaningful to these students, then we must provide applications appropriate to each course. These applications make the course material clearer and the presentation more interesting. Yet applications often are a subject of controversy. Many faculty disavow the use of applications in lower division courses, claiming that they are "unrealistic" or "artificial" or "simplistic." If unrealistic or artificial mean, for example, working with a cost function $C(q)$ where $C(0) = 0$ or where $C'(q)$ is negative somewhere, they certainly are right. But these examples can still serve a real educational purpose; just ask the students what, if anything, is wrong with them. However, if simplistic means an example has been simplified, then there is nothing wrong with it. We must remember that when we construct complex models, some simplifications, or maybe a lot of simplifications, take place before analytic form is found to represent the model . That is why the last step in the modeling process – checking to see if the solution to the simplified analytical representation is actually a reasonable approximation to a solution of the original problem – is so important. In our example, it is reasonable to work with cost – and revenue and profit – functions involving only one variable to describe parts of microeconomic theory because they do introduce the basics of mathematical modeling using understandable applications of basic calculus. Similar com-

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ELECTIONS

KIMBERLY VINCENT, WASHINGTON STATE UNIVERSITY

This year you will be electing a new Chair. If you are a member of SIGMAA QL you should have received information on the electronic election process. I will be stepping down as Chair and Cinnamon Hillyard will take on the role of Chair. The election this year is for Chair Elect. The winner will serve as Chair Elect and aid and learn from Cinnamon's leadership. Then they will become Chair in 2010, for a one year term, after which they will be Past Chair for one year. This allows the SIGMAA to maintain continuity as the people holding officer change allowing the history of our organization to be passed along. Our treasurer, Semra Kilic-Bahi and webmaster, Aaron Montgomery will maintain their positions again this year. The winner of the election will be announced at our annual meeting 5:45 – 7:15 pm January 6, 2009 at the JMM in Washington DC.

We have two candidates for the position of Chair Elect this year. Please if you have not voted yet take a moment to read their autobiographies and go to the MAA website to cast your vote for the Chair Elect of SIGMAA QL. If you are a member of SIGMAA QL and have not received notification of the election contact Stephen DeSanto (sdesanto@maa.org). If you do not want to vote electronically you may contact S. DeSanto for a paper ballot.

STUART BOERSMA

Stuart Boersma is a professor of mathematics at Central Washington University, a Project NExT Fellow (green dot), a member of the National Numeracy Network and the MAA, an associate editor for the journal Numeracy, and has been a member of SIGMAA-QL since its inception. He served as chair of the Pacific Northwest section of the MAA from 2005-2007. Dr. Boersma has spoken to a wide range of audiences about the value of quantitative reasoning in today's society. He has given numerous such presentations at MAA meetings (both regional meetings of the MAA and the Joint Mathematics Meetings) as well as to more academically diverse populations (such as those attending the eighth and ninth Annual National Summer Institutes on Learning Communities). He has received support from the National Science Foundation for several projects which focus on the interdisciplinary nature of collegiate mathematics and is always excited to hear about new and rewarding collaborations between mathematicians and others dedicated to effective undergraduate instruction. If elected chair, he would work to increase membership in SIGMAA-QL (particularly two-year faculty and secondary teachers) and continue to provide venues for disseminating QL best practices. Dr. Boersma will be presenting two papers at JMM, Wednesday January 7, 2009 during the Contributed Paper Session "Quantitative Literacy Across the Curriculum."

ERIC GAZE

Eric Gaze is an Associate Professor of Mathematics and Education at Alfred University. He is the mathematics coordinator for the Master of Science program in Numeracy, the first of its kind in the country, and has spent the last two years developing curriculum for this graduate program. He is a member of the Mathematical Association of America¹s Special Interest Group on Quantitative Literacy (SIGMAA QL). He is a charter member of the National Numeracy Network (NNN), and currently serves on the Board of Directors for this organization. Current research projects include a textbook, Numeracy, A Quantitative Literacy: Communicating with Numbers, and writing a monthly column for the NNN¹s website, Ratiocination: (http://serc.carleton.edu/nnn/columns.html). He lives on a small farm in Western New York with his wife and daughter raising alpacas, (www.gazeacresalpaca.com). See an excerpt from one of his monthly columns in this newsletter).

Joint Math Meetings, January 2008
From Left to Right: Cinnamon Hillyard, Chair-Elect Σ-QL, Maura Mast, Past Chair Σ-QL, Caren Diefenderfer, Chair Emeritus Σ-QL, Nicole Hoover, Director Quantitative Skills Center UW Bothell, Judy Moran, Chair Emeritus Σ-QL, Corrine Taylor, President NNN.

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should prepare students for the needs of their current and future lives (OECD, 1999, as cited in De Lange, 2001). These notions of mathematical literacy became known as advanced mathematical literacy (AML) and basic mathematical literacy (BML) (De Lange, 2001), but they did not address the need for teaching mathematics for "transformative change." Teaching mathematics for transformative change empowers students with mathematical confidence to think critically as an individual and prepares them with the skills necessary to challenge oppressive social structures.

What I call the second generation of new-modern interpretations of mathematical literacy includes teaching for transformative change and is known as critical pedagogy (Gutstein, 2006), critical mathematics education (Frankenstein, 1983; Skovsmose, 2004), and education for liberation (Gutstein, 2003, 2006). Until recently, researchers have primarily interpreted mathematical literacy using the new-modern definition oriented toward interpreting workplace encounters and preparing students quantitatively to meet the needs of their everyday situations. Mathematics education researchers from North America have tended to view mathematical literacy in terms of competencies for mathematical reasoning (i.e., arithmetic skills, symbolic manipulation) and skills young adults need to participate in a technology-based culture.

Thus, researchers mostly excluded mathematics for transformative social change in their interpretations of new-modern mathematical literacy. Adhering only to AML or BML meant that mathematicians and mathematics educators had to choose which camp to participate in. Following AML pedagogy principles meant developing students' problem-solving and symbolic-reasoning skills, while following BML pedagogy meant developing students' functional skills necessary for daily interactions with people, institutions, and technology. A contemporary understanding should address a third need, the need for incorporating critical mathematical literacy (CML) into a broader understanding of mathematical literacy.

ADVANCED MATHEMATICAL LITERACY DEMONSTRATION PROBLEM.

A mantid is an insect that we often call the praying mantis. Mantids are used in biological studies because they are the insect version of the sloth. They rarely move, so it is very easy to keep track of them. Researchers have been studying the relationship between the distance a mantid will move to seek food and the amount of food already in its stomach. The distance is measured in millimeters and the amount of food is measured in centigrams. In the research, food was placed progressively nearer to a mantid. The distance the mantid began to move toward the food was labeled the maximal distance of reaction (R). The amount of food in the mantid stomach was measured. This amount was called the degree of satiation (S). Measurements for 15 mantids are given below.

S (CG)	11	18	23	31	35	40	46	53	59	66	70	72	75	86	90
R (mm)	65	52	44	42	34	23	23	8	4	1	0	0	0	0	0

Can you find an appropriate function to model the relationship between these variables?

BASIC MATHEMATICAL LITERACY DEMONSTRATION PROBLEM.

You need to borrow $10,000. See the newspaper ad for Home Equity Loans provided. Explain to the interviewer how you would compute the total amount of interest charges you would pay under this loan plan.

ADVANCED MATHEMATICAL LITERACY (AML)

The characteristics of AML include procedural fluency; the ability to formulate, represent, and solve a disposition as a doer of mathematics (Kilpatrick, 2001); the confidence to approach complex problems (Steen, 2001); consciousness of what has been learned; the capacity for aesthetic appreciation; and fluency with the language of mathematics (Mathematics Council of the Alberta Teachers' Association, 2005). An example of a problem educators might use in advanced mathematical literacy environments is shown to the left.

BASIC MATHEMATICAL LITERACY (BML)

Next, we consider the characteristics of BML, which include the knowledge and beliefs needed to engage in everyday quantitative situations, as well as the dispositions, habits of mind, communication abilities, and problem-solving skills needed to engage in such situations (Statistics Canada & Organization for Economic Cooperation and Development, 2005); the contextual use of mathematics (Mathematics Council of the Alberta Teachers' Association, 2005); the meaningful use of mathematics in ways that meet an individual's life needs as a reflective citizen (Organization for Economic Cooperation and Development, 2006); the quantitative ability to understand commonplace issues (Steen, 2001); the ability to use mathematics in the routine tasks of life; the skills necessary for employment; and an appreciation for the recreational uses of mathematics (Steen, 1997). To the left is an example of a basic mathematical literacy problem educators might use.

CRITICAL MATHEMATICAL LITERACY (CML)

Finally, consider the characteristics of CML. These include culturally valuing mathematics and the reflective ca-

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pacities to mathematically understand major policy issues (Steen, 1997); conceptual understanding and adaptive reasoning capacities (Kilpatrick, 2001); having fluency with the language of mathematics, the skills necessary to connect mathematics with the real world, and the capacity to evaluate the mathematical thinking of others (Mathematics Council of the Alberta Teachers' Association, 2005); having the understanding necessary to make well-founded judgments and an understanding of how mathematics interacts with the world (Organization for Economic Cooperation and Development, 2006); having the mathematical confidence to confront authorities and being empowered to think mathematically as an individual (Steen, 2001); being prepared to use mathematics to investigate and critique injustice and having the skills necessary to mathematically challenge oppressive structures (Gutstein, 2006). Below is an example of a problem educators might use in a critical mathematics literacy situation.

CRITICAL MATHEMATICS LITERACY DEMONSTRATION PROBLEM.

Recently there has been concern that the greenhouse effect is being intensified artificially, resulting in global warming. Using the data below, conjecture whether there is a connection between increased carbon dioxide levels in the atmosphere and rising average temperatures over the whole planet. Is this a potentially serious environmental problem?

YEAR	CO2 Concentration (ppm)	Temperature (°C deviation from mean 1961–1990)
1960	317	-0.03
1965	320	-0.11
1970	326	-0.09
1975	331	-0.07
1980	338	0.05
1985	346	0.11
1990	354	0.20
1995	362	0.29
2000	371	0.34

- Produce three scatterplots, one each for the (year, carbon dioxide concentration), (year, temp deviation), and (carbon dioxide concentration, temp dev) data.
- Does there appear to be an association between any pair of variables? Comment on what you think the scatterplots reveal. What statistical measures do you think would be helpful to obtain? Why?
- Write a report that you will submit to a group of citizens or a political action group. In the report, summarize your analysis of the relationship between CO2 levels and changes in the Earth's climate. Include a discussion of the overall trend during the 1960–2000 period, trends within that period, measures of correlation, and possibilities of a cause-and-effect relationship.

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LETTER

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Another aspect of the math wars is the use of standard algorithms (efficiency of use) versus developing conceptual understanding. As a mathematician and mathematics educator I know that one goal when learning mathematics is to develop abstraction that allows for generalizations. I also know that memorizing facts and algorithms does not promote the ability to generalize. Examining patterns, making and testing conjectures, understanding the process, and discovering the math are some of the strategies teachers employ to improve students' abilities to generalize. But some parents see this as fuzzy math if they do not understand the value or process of getting to an abstract level. This ability to generalize and think in the abstract is thought to provide people the tools necessary to apply the same mathematical process in many different contexts; however, many researchers recognize that people may be able to do mathematics in one context but cannot transfer the same process to another situation. I heard Caren Diefenderfer explain that the goal of QL is to use and interpret the mathematics in real world contexts that are authentic and thus maybe a bit messy. Thus, our work in quantitative literacy is one way to continue to work in context rich environments while reinforcing ability to apply generalized mathematical concepts. Concepts including but not limited to: unit conversion, ratio, proportional reasoning, central tendency and distribution of data. QL is often the ignored step child of the unsettled questions surrounding what mathematics education should look like. Despite the disagreement on what school mathematics should look like, we do know that we must improve the quantitative literacy skills of our citizens, now.

More and more schools, K-12, college and university levels are making inroads to including more work with QL. Now more than ever we want our citizens to have an understanding of all that is quantitative as we prepare for the United States presidential election and contemplate how to survive when our global economy has gone bad. The troubled times we are in reinforce the need for our work to improve quantitative literacy for all. I appreciate all of the people out there trying to help our citizens make more informed choices in this world through an improved ability to interpret and use quantitative information. Please keep up this important work despite the obstacles we encounter.

SIGMAA-QL has active members striving to improve how people interpret quantitative information. So what has SIGMAA-QL been involved with this past year? Well, it is a lot, since I am fortunate to have an excellent executive committee that is comprised of very active people who are involved in many projects. Here are few of the highlights that our members of SIGMAA-QL have done on behalf of furthering the quantitative literacy of our citizens.

AT THE NATIONAL SCENE:

- Maura Mast and I joined Bill Martin and Bernie Madison to co-host a Contributed Paper Session at the 2008 Joint Mathematics meetings on the topic of Assessment of Student Learning in Undergraduate Mathematics, co-sponsored by SIGMAA-QL and Project SUAM.
- Caren Diefenderfer, Nicole Hoover, Judith Moran and Corrine Taylor were panelists for a discussion on "The Role of Quantitative Literacy Centers in Supporting Students and Faculty" at Mathfest, moderated by Maura Mast and sponsored by SIGMAA-QL. You can see the presentations by going to http://pc88092.math.cwu.edu/~montgomery/sigmaaql/meetings.php.
- SIGMAA-QL also sponsored the Mathfest panel "Math Matters: Numerate Approaches to Everyday Life", with presentations by Bernie Madison, Don Saari, Jonathan Hodge, and Andy Miller. SIGMAA-QL members came together for a wonderful lunch after that panel.

AT LOCAL LEVELS

- Semra Kilic-Bahi and Ben Steele organized three QL events at Colby Sawyer. (see their article in this news letter).
- Caren Diefenderfer and colleague Ruth Doan facilitated workshops and spoke to faculty at large at Washington State University in April 2008 in the annual Provost's Speakers Series. They shared samples, worked with faculty on identifying important QL issues and equally important met with Deans and provosts to discuss next steps in integrating QL in all majors.
- I ran summer workshops for all high school faculty at a high school in Washington. The workshops were designed to help all teachers to understand quantitative literacy and the connection to their content areas. The teachers look forward to incorporating QL projects in their classes this fall.
- Bernie Madison's QL class based on newspaper articles has begun to spread and is now being used in Washington and Virginia. Come to JMM in Januart 2009 and our CPS Wednesday morning to learn more.

This list goes on… In the upcoming year it is my hope that more of you will share with SIGMAA-QL by contacting the members of our executive team, asking questions on the list-serv, sharing what you are doing to promote quantitative literacy, or organizing an event at a meeting. I appreciate the opportunity to be the Chair of SIGMAA-QL.

ELECTRONIC RESOURCES

SIGMAA-QL members can use the SIGMAA-QL listserve by mailing messages to <sigmaa-ql@enterprise.maa.org>. All members should have been signed up for this service when they became SIGMAA-QL members, but if you are not able to access the list-serve, please contact the current Secretary-Treasurer.

Anyone can access the SIGMAA-QL web site at <http://www.maa.org/sigmaa/ql/>. It contains news and resources associated with QL. Please send news, announcements, resources, photographs, and anything else related to Quantitative Literacy to the current Webmaster for inclusion on the web site. If you have trouble accessing the web site, please let the current Webmaster know. You can find our email addresses on page 4 under CURRENT OFFICERS.

CONTRIBUTE!

Tell us what you have done or are doing and we'll include it in the *SIGMAA QL Newsletter* (email submissions to the Chair). Consider *Numeracy* (published by the National Numeracy Network) for more scholarly contributions.

COLLABORATIONS

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featured presentations and discussion led by faculty members in mathematics, psychology, geology, technical communications, writing and other disciplines. The NECQL which was initiated by a small group of participants from New England area has been steadily growing; around 30 institutions are part of the consortium.

The NECQL conference started with a brief description of QL project at Colby-Sawyer College. For more information about this initiative, please visit

http://www.colby-sawyer.edu/academics/experience/quantitative/index.html and see the Numeracy article http://services.bepress.com/numeracy/vol1/iss2/art3.

"Calculations and Context" was the title of the presentation given by Caren Diefenderfer of Hollins University; Bernie Madison of University of Arkansas; Stuart Boersma of Central Washington University. Don Small talked about Contemporary College Algebra as a basis for QL. Priscilla Bremser of Middlebury College talked about "Mathematics of, for, and as Social Justice."

Maura Mast of the University of Massachusetts in Boston representing SIGMAA-QL as the past chair presented gifts for Judith Moran of Trinity College and Caren Diefenderfer of Hollins University (two colleagues who were instrumental in formalizing SIGMAA-QL) in acknowledgement of their contributions to SIGMAA-QL.

Len Vacher of University of South Florida talked about the new online Numeracy journal and analyzed the connections among numeracy related publications. "Making Time for it All: Integrating Writing, Speaking, and Quantitative Reasoning in Disciplinary Courses" was the keynote address given by Mya Poe of MIT. The last talk of the conference "Illuminating Arguments with the Power of Numbers" was presented by Neil Lutsky of Carleton College.

The NECQL conference was sponsored in part by Colby-Sawyer College's three-year NSF DUE-CCLI-#0633133 grant, "Quantitative Literacy Across the Curriculum in a Liberal Arts Setting."

REFERENCES AND URLS

Benjamin Steele and Semra Kiliç-Bahi (2008) "Quantitative Literacy Across the Curriculum: A Case Study," Numeracy: Vol. 1 : Iss. 2, Article 3. Available at: http://services.bepress.com/numeracy/vol1/iss2/art3

National Numeracy Network: http://serc.carleton.edu/nnn

12th NECQL Conference: http://www.colby-sawyer.edu/academic/liberaleducation/quantitative/index.html

Carleton's Quantitative Inquiry, Reasoning, and Knowledge (QUirk) Initiative website: http://serc.carleton.edu/quirk/index.html

Bernie Madison (talking with Len Vacher)

PROMOTE

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ments apply to applications in other areas.

For many of us, it probably is against our nature to advertise ourselves. But this is not a "the sky is falling" article. For example, the percentage of freshmen taking calculus in high school is increasing, which in turn will decrease the number of freshmen who will take calculus at our institutions. The projected increase in college enrollments over the next ten years or so will not be enough to offset this loss. The possible outsourcing of mathematics instruction is a real concern, which is why emphasizing quantitative literacy is so important. If we are to continue to be the major source of mathematics instruction within our institutions, we simply have to make efforts in that direction.

TRAINING

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and to include new and returning tutors throughout.

We also spend time doing some quantitative reasoning. Prior to the training, I have the tutors prioritize what content they would most like to review. There are a few courses that almost all of the tutors are able to work with (statistics, precalculus, and calculus). So we spend time reviewing specific content from these courses. I also invite faculty to the training to talk about their courses and to highlight important concepts for the tutors

Throughout the remainder of the quarter, we have one or two more content-driven trainings, which a faculty member or I lead. We spend some time checking in to see how things are going, but most of the training is spent on reviewing mathematics material. The bulk of the tutors' content training is done via Blackboard, a course management system. I have materials posted on our course site that the tutors can review during their down-time. I also post assignments I receive from faculty so that the tutors know what to expect and have some time to think about the problems before the students come in with questions. Some professors prefer to have the tutors enroll in the Blackboard sites for their course and to check that regularly in order to follow the progress of the class.

At the end of each quarter, the tutors complete a self-evaluation and answer questions about how their work in the QSC is going, what types of things they are doing well and what they would like to improve on in future quarters. I provide each tutor with a written response, and I meet with some of them individually. Because my time is divided between my work with the tutors and my work supporting faculty, I do not train or give feedback as often or as consistently as I would like. We are hoping to soon hire a staff member dedicated to working closely with the tutors and providing them with consistent training and feedback throughout the quarter.

If you would like more information, or if you would like to see a copy of our Tutor Handbook, please contact Nicole Hoover at nhoover@uwb.edu or visit our web site at http://www.uwb.edu/qsc.

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