January 2001

Mathbits

Minnesota Council of Teachers of Mathematics www.mctm.org

NCTM'S *Principles and Standards for School Mathematics*

The Principles

This article continues a series on the NCTM *Principles and Standards for School Mathematics* for the purpose of stimulating ideas and ongoing conversations about how best to help students gain a deep understanding of important mathematics. The focus of this article is o the Principles. It briefly discusses each of the six principles that form the foundation for the standards and poses several questions intended to clarify our thinking about our beliefs and practices.

Equity

The Equity Principle. Excellence in mathematics education requires equity--high expectations and strong support for all students. Equity does not mean that all students should receive identical instruction, rather it means that all students should have access to meaningful mathematics and that reasonable and appropriate accommodations be made to promote attainmei for all students.

In our beliefs:
Do we believe all students can learn meaningful mathematics?
Do we believe all students should study a common foundation of challenging mathematics?

In our practice:
Are we willing to accommodate differences to help everyone learn mathematics?

Curriculum

The Curriculum Principle. A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades. An effectiv mathematics curriculum focuses on important mathematics--mathematics that will prepare students for continued study and for solving problems in a variety of settings.

In our practice:
Can we identify and agree upon what is important mathematics?
Do we connect ideas from the various strands of mathematics and to areas other than mathematics, or do we teach mathematics as a collection of isolated, unrelated facts?
Does what we did today connect to what we did yesterday? Does what we did this year connect to what we did in previous years? In other words, does new content build upon previously learned ideas?
Is new, challenging, and focused mathematics presented each year, or are many topics repeated and reviewed year after year?
Are we willing to forego the teaching of long-time, favorite activities that do not foster connections?

Teaching

The Teaching Principle. Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well. Teaching mathematics well is a complex endeavor, and there are no easy recipes. In addition, there is no one "right way" to teach.

(Continued on page 2)

Mathbits

The Principles
(Continued from page1)

Learning

In our practice:
Do we have a solid conceptual understanding of the mathematics we are teaching?
Do we employ a variety of instructional strategies to help all students create their own understanding of the important mathematics?
Do we have opportunities to reflect on and refine instructional practices?

The Learning Principle. Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge. Unfortunately, learning mathematics without understanding has long been a common outcome of mathematics instruction. Students who memorize facts or procedures without understanding often are not sure when or how to use what they know. In the twenty-first century, all students should be expected to understand and be able to apply mathematics.

In our beliefs:
Do we believe conceptual understanding can be developed in concert with skills?

In our practice:
Do we ground concepts in a context that is meaningful to students?
Do students learn mathematics by rote?
Do we actively engage students in activities that promote the learning of meaningful mathematics?

Assessment

The Assessment Principle. Assessment should support the learning of important mathematics and furnish useful information to both teachers and students. When assessment is an integral part of mathematics instruction, it contributes significantly to all students' mathematics learning.

In our practice:
Is assessment an ongoing routine, embedded in the instructional process?
Do we use a variety of assessments focusing on students' understanding as well as their skills?
Do we use assessment to make informed decisions regarding instruction?
Do we use assessment for the sole purpose of assigning a grade?

Technology

The Technology Principle. Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning. Students can learn more mathematics more deeply with the appropriate use of technology. When technological tools are available, students can focus on decision making, reflection, reasoning, and problem solving.

In our practice:
Do we use technology to enhance instruction or does the technology become the focus of the instruction?
Do we allow technology to make sophisticated mathematics accessible to all students?

The six principles address overarching themes. They describe crucial issues that can influence the selection of curriculum materials, the planning of instructional units or lessons, the design of assessments, the instructional decisions in the classroom, and the establishment of supportive professional development programs for teachers. Their power as guides in decision making comes from their interactions when they are considered together rather than as separate entities.

Tom Muchlinski, MCTM President-Elect

Mathematics Education in Minnesota

A report from the State Mathematics Specialist

Greetings from the Department of Children Families & Learning!

I would like to bring you up to date on some recent reports related to mathematics education in Minnesota and direct you to the full reports for further reading.

Before It's Too Late: A Report to the Nation from the National Commission on Mathematics and Science Teaching for the 21st Century. September, 2000.
The report of the commission, chaired by John Glenn, focuses on three goals: improving the quality of mathematics and science teaching, increasing the number of mathematics and science teachers, and improving the working environment of teachers. The full report is available at: http://ed.gov/americacounts/glenn/toc.html

Aiming Higher: A Report on Education Standards and Policy for Minnesota. November, 2000.
The report, commissioned by the state and prepared by Achieve, Inc and the council for Basic Education, evaluates Minnesota's high standards from both a policy and content perspective. The full report is available at: http://www.achieve.org/achieve/

Minnesota and TIMSS: Exploring High Achievement in Eighth Grade Science.
September, 2000.
This report, published by the National Educational Goals Panel, studies and attempts to explain why the same Minnesota students who did very well in the TIMSS science test had only slightly above average performance on the TIMSS math test. Among the suggested explanations were the following:
· Science curriculum in Minnesota focuses on fewer topics done in more depth.
· Science instruction tended to be more active and inquiry based; math instruction tended to be more textbook based and traditional.
· 8th grade science classes in Minnesota tend not to be tracked (90%), giving all students the same opportunity to learn important content; 8th grade math classes tend to be tracked (90%), excluding many students from an opportunity to learn anything beyond arithmetic.
· Science programs in Minnesota have been more stable and less subject to political swings over time than math programs.
The full report may be found at: www.negp.gov/reports/mntimss.pdf

Racial Disparities in Minnesota Basic Standards Test Scores. October, 2000.
This report was published by the Roy Wilkins Center for Human Relations and Social Justice of the Humphrey Institute for Public Affairs, Dr. Sam Myers, Jr., Director. This report studied scores of students on the Basic Standards Tests in Math and Reading from 1996 to 2000, and analyzed the changes among ethnic subgroups during that period. Among the key findings are:
· Racial gaps narrowed for reading test scores, while they widened for math scores.
· Attendance has a very significant effect on scores, and a larger effect on math scores than reading scores.
· There is not only no adverse impact of improved reading scores on schoolwide math scores, but schools with improved reading scores were more likely to have improved math scores.
The full report is available at: www.hhh.umn.edu/centers/wilkins/pubs.htm

If you have further questions after reading any of the reports, feel free to call or e-mail me at (651) 582-8859 or sharon.stenglein@state.mn.us

Sharon Stenglein
State Mathematics Specialist

Where's Martha? Contest Winner

The winner of the first MCTM website contest is Donna Poshusta from the Academy of Holy Angels. She will get a free MCTM membership for one year. Congratulations, Donna!

President-elect Tom Muchlinski is featured in the current website contest. Visit www.mctm.org to enter.

Mathbits

A Review of NCTM's 2000 Yearbook, *Learning Mathematics for a New Century*

As the year 2000 and the 20th century drew to a close, I chose to read and review the National Council of Teachers of Mathematics 2000 Yearbook, Learning Mathematics for a New Century (published by NCTM, Inc., 2000, 235 pages). The yearbook, with its sixteen articles from thirty-five contributing authors, provides the reader with a reflection on where we have been, as well as shared visions of what might be and what factors might shape the future. Some recurring themes in the yearbook are technology, equity, policy, inquiry, classroom discourse, and standards.

Following the preface by Maurice L. Burke, 2000 Yearbook Editor, the volume continues with a prologue by Stephen S. Willoughby in which he discusses the following questions: Where have we been? Why is mathematics education important in the 21st century? What is the role of technology? and Where shall we go?. Further discussion of these questions occurs throughout the yearbook, which consists of four parts: Numeracy and Standards, Technology and the Mathematics Classroom, The School Mathematics Curriculum, and Improving Mathematical Learning Environments. Although there are many excellent papers, this review focuses on one article in each of the yearbook's sections.

In "The Many Roads to Numeracy," Dorothy Wallace of Dartmouth College discusses the ill-defined but widely applauded push for quantitative literacy. How do we decide what a person should know to be "quantitatively literate?" Wallace explains that to answer this question, we need to consider two perspectives—individual fulfillment and societal demands. She goes on to describe a National Science Foundation funded project first implemented at Dartmouth in 1994, in which mathematics is integrated with a variety of disciplines throughout the college.

Lyn D. English and Donald H. Cudmore contributed the article, "Using Extranets in Fostering International Communities of Mathematical Inquiry." The authors describe a program implemented in 1997 across many nations including the United Kingdom, Canada, Taiwan, and Australia, in which students solve problems together over the World Wide Web. Through this program, students and teachers are engaged in problems that allow them to share data, exchange mathematical ideas, undertake collaborative investigative projects, publish student work, and to develop an appreciation for one another's cultures. I encourage the reader to refer to this article to see the rich problems the students were working on, their creative solutions, and their mathematical conversations throughout the process.

It's not surprising that the School Mathematics Curriculum part of the yearbook includes an article on Standards-based curricula. In their paper, "The Impact of Standards-Based Instructional Materials in Mathematics in the Classroom," Eric E. Robinson, Margaret F. Robinson, and John C. Maceli consider five features of several National Science Foundation funded Standards-based curriculum projects. The authors examine the impact in the classroom on each curriculum's philosophical focus, instructional and pedagogical strategies, approaches to algorithms, choice of mathematical content, and use of technology. This article provides valuable information for teachers and would be especially helpful for schools that are considering a change to one of the NSF funded projects.

Miriam Gamoran Sherin, Edith Prentice Mendez, and David A. Louis spent the past several years investigating how teachers foster mathematical discourse in their classrooms. In their article, "Talking about Math Talk," the authors present a simple model for how teachers can build and support discourse: (a) explain-- give a reason for your idea(s), (b) build-- build on other students' ideas, and (c) go beyond-- generalize from a specific example to a broader issue. The article goes on to discuss these strategies in the context of a lesson taught in David Louis's classroom.

Overall, I found the content of this yearbook to be highly relevant and informative. The only area of improvement, in my opinion, is the balance between secondary and elementary mathematics education, as there seems to be more focus on topics and issues pertaining to the middle and high school levels. Nonetheless, like other volumes in this series, the NCTM 2000 Yearbook would be a valuable addition to one's personal mathematics education library.

Sara Lenertz, Co-NCTM Representative

What's Happening? Elementary

Number and Operations is one of the ten Standards in the NCTM *Principles and Standards for School Mathematics* and one that is heavily emphasized in the elementary grades. This article focuses on one goal of the Number and Operations Standard: for all students to compute fluently and make reasonable estimates. Computational fluency refers to having efficient and accurate methods for computing.

All students should know basic number combinations. The learning of these facts should not focus on memorization, rather the facts should be learned with understanding. Computational skill can be accomplished in conjunction with the development of conceptual understanding by presenting computation in a wide variety of meaningful contexts. As students experience various situations that require specific operations, they come to understand what the operation means as well as how to perform the operation.

Activities to Support the Number and Operations Standard

Meaningful practice is necessary to develop fluency with basic number combinations and strategies. Practice needs to be motivating and systematic if students are to develop computational fluency. This practice can be conducted in the context of other activities, including games or focused activities that are part of another mathematical investigation. This practice should be purposeful and should focus on developing thinking strategies and a knowledge of number relationships rather than drill isolated facts.

NIM

One activity that provides such purposeful practice is the game of NIM. Students play the game in pairs and compete to reach a target number. To begin, the players agree on a target number, such as 50. The first player chooses a number from 1 to 9. The second player then chooses a number from 1 to 9 to add to the first number. Players alternately add a number from 1 to 9 to the running sum until one player reaches exactly 50 and is the winner. While this game provides practice in an interesting manner, it also requires students to use problem solving and reasoning as they try to reach the target. Students should be encouraged to work out a strategy for winning. (In order to win they must be the person to reach exactly 40, 30, 20 and 10. Since the first student can only get to 9, the second student is guaranteed to be the one to reach 10 and therefore eventually 50.) The game can be altered by choosing a different target number and by allowing the use of a different range of numbers. Another variation is to start at a number such as 30 and subtract numbers say from 1 to 5 to reach 0. NIM also is a nice calculator activity.

KRYPTO

A second activity that promotes purposeful practice of computation in the spirit of the Number and Operations Standard is the game of KRYPTO. Students pick five numbers between 1 and 25. They then pick a sixth number between 1 and 25 as the target number. The objective is to reach the target number by using, in any order, each of the five numbers exactly once and the four basic operations. KRYPTO is an excellent cooperative group activity as well as an effective calculator activity. A scoring scheme that awards 1,000 points for using all five numbers, 500 points for using four numbers, and 250 points for using three numbers, can be used to provide a competitive component to a group activity

When selecting activities, whether they are for providing practice with computation or for developing a concept, we should strive to use robust activities. We maximize the use of instructional time when we use activities that integrate several important concepts as well as require the use of several processes. We should choose activities purposefully, always asking the question, "What is the important mathematics students should come away with upon completion of this activity?"

Karen Coblentz, Vice President, Elementary

I. MATHCOUNTS Competitions

MSPE Receives Hero's Award

The Minnesota Society of Professional Engineers has received a Hero's Award from the Minnesota Academic Excellence Foundation (MAEF). The MAEF Hero Awards promotes and recognizes citizen involvement and innovative partnerships which support improved levels of school performance and student achievement.

The Society was recognized for its MATHCOUNTS program, which is committed to improving the mathematical skills of Minnesota students, increasing student interest in math, improving the quality of math education and providing recognition of academic achievement among middle school students. This is the 18th year that MATHCOUNTS has conducted its combination coaching and competition program in Minnesota.
The schedule for competitions is:
Chapter competitions - Feb. 3-25
State competition - March 16-17
National competition - May 11

More information about MATHCOUNTS and specific dates for chapter competitions can be found on its website at http://mnspe.org/mathcounts.

II. Congrats!

Congratulations to the following MCTM members who achieved certification by the National Board for Professional Teaching Standards in November, 2000:

Barbara Duffrin, Roseville Area Schools
Bernadette Green, Minneapolis Public Schools, Special District 1
Sara VanDerWerf, Minneapolis Public Schools
Mary Moreira, Minneapolis Public Schools
Thomas Young, Independent School District 16
Ranae Nelson, Wheaton Area Schools

Mathbits

Published by

Minnesota Council of Teachers of Mathematics

P.O. Box 120418
New Brighton,
MN 55112

www.mctm.org

Martha Wallace, President
507- 646-3408 - W
507- 334-3675 - H
wallace@stolaf.edu

Arnie Cutler, Executive Director
612- 626-8326 - W
651- 631-2136 - H
cutler@tc.umn.edu

Pam Brethorst, Editor
507- 646-3573 - W
651- 690-9075 - H
brethors@stolaf.edu

Forwarding and Return Postage Guaranteed
Address Service Requested

Non-Profit
U.S. Postage
PAID
Permit No. 1967
Minneapolis, MN