**Writing About Math**

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Writing about math can be a very positive and fruitful learning experience. Here's a look at some of the benefits; a variety of writing categories and topics; and suggestions for creating a positive environment for writing about math.

**WHY WRITE IN MATH CLASS?**

Writing can help students think about ideas in new ways and develop critical thinking skills, while involving students directly in the learning process. When students incorporate personal experiences into their writing, learning becomes more meaningful. Writing opens new lines of communication between student and teacher, and teachers can use students' writing to assess understanding and make instructional decisions. Informal writing can make a topic more appealing and stimulate creativity. Writing about math can be a path to understanding, as students clarify and "take ownership" of concepts and connect math to the real world.

**WRITING SUPPORTS NCTM PROCESS STANDARDS**

As you read through this partial listing of [NCTM Process Standards](http://standards.nctm.org/document/appendix/process.htm), reflect on how writing about math can engage students in each.  **Problem Solving**

* solve problems that arise in mathematics and in other contexts
* apply and adapt a variety of appropriate strategies to solve problems
* monitor and reflect on the process of mathematical problem solving

**Reasoning and Proof**

* make and investigate mathematical conjectures
* select and use various types of reasoning and methods of proof

**Communication**

* organize and consolidate mathematical thinking though communication
* communicate mathematical thinking coherently and clearly to peers, teachers, and others
* analyze and evaluate the mathematical thinking and strategies of others
* use the language of mathematics to express mathematical ideas precisely

**Connections**

* recognize and use connections among mathematical ideas
* recognize and apply mathematics in contexts outside of mathematics

**Representations**

* create and use representations to organize, record, and communicate mathematical ideas

**TYPES OF WRITING ABOUT MATH**

Writing to explain how a problem was solved is a common and valuable form of mathematical writing, but it's just one of many possible forms. Writing in different genres taps different ways of thinking and keeps assignments fresh. Here's a grab bag of possibilities:

* Learning log, journal, or blog A math journal can be kept in a composition book or spiral notebook, or can be recorded in an online blog if students have easy access to computers. It's great when a teacher or classmates write short responses to entries in learning logs or blogs, but not every entry needs a comment if students are writing frequently. Topics can be drawn from any of the categories in this section, or might include
  + Write about what you did.
  + Write about what you learned.
  + Write about what you're not sure about or wondering about.
  + Write/reflect at the beginning and end of a unit.
  + Comment on assignments.
  + Debrief: Explain the best or most important ideas or steps or new words.
  + Write about the learning process.
* Freewriting Write rapidly for a short, fixed amount of time to "dump out ideas."
* One-Minute Paper To gauge understanding or reactions
* Explain mathematical ideas; construct meanings Examples: What is subtraction? What games involve chance, strategy, or both? Compare different procedures.
* Explain in detail how you solved a math problem Encourage students to write a clear, concise paragraph, citing the strategy chosen and describing the steps used to implement the strategy.
* Create word problems or test questions.
* Respond to word problems.
* Write to vent (anonymously) or make suggestions.
* Write to ask or answer questions. Questions can be shared anonymously for more candid input. They can be written on sticky notes placed in a "parking lot" on a large paper on the wall. Classmates can help categorize and answer the questions.
* Write creatively to explore, have fun, and look at math in fresh new ways. The ideas are endless. Consider:
  + math poetry
  + math-related jokes or riddles
  + math-related comics
  + fictional stories relating to math -- illustrations welcome!
  + lively essays on a math topic
  + ads for math, or math class, or a number
  + math mad libs
  + math "love letters" from a one number or operation to another
* Write to inform or teach in the "real world."
  + how to make a math craft
  + step-by-step strategies
  + recipes
  + directions or descriptions using math vocabulary
  + summary of a news article utilizing data to support the main idea
* Write to persuade Using real-life data to support an argument helps students see the power of math in daily life. For example, a persuasive essay on "the greatest baseball hero of all time" or "why we need to be green" or even "why we need a longer lunch period" surely would use data to support the thesis.
* Write a friendly letter  The letter can be to a real or imaginary audience, on a math topic of interest.
* Define vocabulary
* Include words from a word bank in an assignment
* Translate an equation into English
* Reword a teacher's explanation in your own words
* Formal papers, including research papers
* Idea box for students' contributions to writing topics

**SET THE STAGE FOR POSITIVE WRITING EXPERIENCES**

The following strategies are some you can use to create an environment in which writing about math is a positive learning experience.

Ask good questions worth communicating about, with multiple possible approaches.

Make sure early activities are fairly easy and satisfying for all students. (We don't want to compound a possible bad attitude about math with a bad attitude about writing! We want writing to enhance the experience of learning math.)

Discuss the assignment before writing time begins. Make sure students understand why you are asking them to write.

Begin with verbal explanations as a shared class activity. As students explain orally, ask questions to help them clarify their responses.

Don't just "assign" writing -- facilitate it in many ways; guide students as they learn how to be more effective thinkers and communicators.

Provide writing prompts -- including guidelines, criteria, rubrics, and strategies.

Share models of successful student writing.

Ask students to consider a specific audience Imagine they are explaining to a young child step by step, or write as if they are mathematicians (using proper terminology).

Provide frequent opportunities for cooperative learning: Discuss beforehand in small groups; write in pairs or small groups; respond to writing in small groups.

During writing time, circulate, ask questions, and elicit ideas

* "What do you have to do?"
* "What ideas do you have?"
* "How will you start?"
* "Tell me something you know."
* "Why do you think that?"

Provide plenty of time for writing.

Provide constructive feedback. Respond to the content.

**EIGHTEEN WRITING TOPICS OR PROMPTS**

1. How long do you think it would take you to count to a million by ones? What makes you think that?
2. How are the numbers 10 and 100 alike? How are they different?
3. What is your favorite shape? it? Why do you like it so much? Write a poem or poster describing why it's so great.
4. How many measurements can you think of to describe yourself? (height, weight, shoe size, and so on)
5. Is a map a measuring device? Why or why not?
6. List five or more kinds of statistics or number facts that are used to talk about baseball and baseball players. How else are numbers used in baseball?
7. Explain how you could multiply 6 x 99 in your head.
8. Estimate how many students are in the whole school. Explain how you came up with your estimate and how you might check the accuracy of the estimate.
9. Write a story problem that cannot be solved because there is not enough information.
10. Describe an object from your bedroom or kitchen using as many numbers and math terms as you can.
11. How do your parents use math? Interview them about it, and then list all the things they do that involve math.
12. What is money? Define it in your own words.
13. Think of three activities you could do to teach the concept of decimals to students who don't speak much English.
14. Would you rather take a test that has 10 questions worth 10 points each, or one with 20 questions worth 5 points each? Or 25 questions worth 4 points each? Or 50 questions worth 2 points each? Explain your reasoning and estimate where you would score the highest.
15. Make up a word problem involving cooking and fractions.
16. Write a letter to the school board to convince them that students should be able to use calculators in math class.
17. Write the numerals from 1 to 9 and answer these questions about them: Which is most artistic? Most expressive? Most colorful? Most useful? Luckiest? Give reasons for your choices.
18. If you could be any number from 1 to 100, which would you be, and why? Which numbers would you choose for friends and family members?

11/18/2008

**Math in the News**

**By Wendy Petti**

**Who needs word problems when the news is rich with real-life math problems?**

Students find math more meaningful and relevant when they can use their math skills to better understand and analyze current events. Below are some practical suggestions for tapping into newspapers and online news sources as an integral part of your math program.

**FINDING MATH-RELATED NEWS**

It's easy to keep an eye on the latest news at [CNN](http://www.cnn.com/), [Yahoo](http://www.yahoo.com/), or [Google News](http://news.google.com/). [Science Daily](http://www.sciencedaily.com/) reports cutting-edge news in the realms of math, science, and technology. Articles archived in Science Dailys [Computers and Math News](http://www.sciencedaily.com/news/computers_math) section have a particularly strong mathematical component. Local newspapers often contain items of interest to students. [Scholastic News Online](http://www.scholastic.com/news) pairs kid-friendly news stories with lesson plans, activities, and quizzes.

**ADAPTING AND SHARING THE NEWS**

News articles tend to be written at a sixth grade reading level. Many of my fourth grade students would have found it difficult to understand the articles I shared if theyd read them independently. I've used these methods to help make the reading material more accessible:

**Oral summary** Sometimes, I just tell students the highlights of an article and write the relevant math information on the board, and then we analyze and discuss the data. I tend to use that approach when the main idea and the math content can be explained very easily, in a few sentences. Otherwise, I'd like my students to have something written -- for reference, highlighting, taking notes, and working with the math.

**Written summary** Sometimes, I compose a short summary of an article's main points in kid-friendly terms. I use the rest of the page to pose a few math-related questions. With that set-up, students can analyze the news article independently or in small groups.

**Guided reading** I frequently copy the text of online articles into word processing documents (along with the Web address, of course) so I can adjust the font size and spacing. By saving online articles as text documents, I also can ensure that I'll have access to them in years to come. Some online news sources may archive news for a few years, but not indefinitely, and AP news stories expire quickly. Typically, I print a copy for each student. They read along silently while I read aloud or students read aloud in turns. I ask them to highlight or underline the math they find in the article. We pause to discuss unfamiliar words and concepts. Sometimes we discuss the math as we come to it, and sometimes we "pull the math" after reading the whole article. After we've gone through the whole article as a class, the students sometimes continue their mathematical analysis in small groups.

**Student oral report** Another option is for a student to take responsibility for presenting a math-related news item to the class. Teacher and student can meet ahead of time to go through the article and agree on key points. As an option, the student also can prepare a few math-related questions to guide whole-class or small-group discussion.

**A partially told story** Withhold some of the math information until students have had a chance to discuss and formulate conjectures, then share "the rest of the story."

**STORING THE NEWS**

Keep two math news binders for the year -- one for news with a short "shelf life" and another for news items that might remain worthy of discussion for years after publication. Include in the binders the math-related questions connected to each article and possibly some samples of student responses. I also like to keep those materials in a news folder on my computer. To promote the home-school connection, its also helpful to post links to the articles and a summary of the discussion on a class Web page.

News with a short shelf life would include most sports articles and much political news. In the fall of 2008, my students were fascinated with election polls and news reports; they loved tracking polling trends, comparing polls in different states, and making predictions, and they got a crash course in percentages, pie charts, and line graphs in the process. Each student kept a copy of the articles and related math activities in a "real life math" section of their math binders. It was a worthwhile mathematical investigation, but I won't be able to use those materials in future years.

Some news items might intrigue students in future years or might be reusable with adaptations. Some dated items also might be worth saving for eventual comparison with updated news reports over time.

Here's an example of a story with a seemingly short shelf life that can be adapted for future use: [Greeley Dealer Offers Savings on a Rainy Day (5/12/09)](http://www.greeleytribune.com/article/20090512/NEWS/905119920/1002/NONE&parentprofile=1001)

Briefly, a car dealership offered to refund the full purchase price of any car or truck bought during a four-day period if it rained at least an inch during a 12-hour period on Memorial Day. That news item stirred lively debate in my math classes. We wondered:

* What are the odds of this town getting this amount of rain?
* How much did the rain insurance cost?
* Did the promotion increase business enough to cover the cost of the insurance?
* What would the weather actually turn out to be like on that date?

Students made predictions about the weather and justified their speculations about the insurance cost. After Memorial Day came and went, I called the dealership to get more information. The amazing thing was that it actually did rain more than an inch in town during the designated 12-hour time block, stirring great excitement at the dealership, but the rain insurance had been taken out on the weather station at the airport, where it rained only half an inch, so no one was able to get refunds on their cars. We learned that the rain insurance cost $10,000 and that sales did increase in the promotional period, but barely enough to cover the cost of the insurance.

Although this little item is no longer current, it still could be adapted for future students like this: "A few years back, a creative car dealer ran a special promotion. Let's see if you can predict how much it cost him and what the outcome was." Students still can have the fun of making predictions, because they can't determine the outcome from the news item itself.

**RESPONDING TO THE NEWS**

We'll want to be sure our students understand the main idea of any news story we bring into class. Can they answer the 5 Ws -- who, what, when, where, why? With that established, as you discuss a news article with your students, ask:

* Where's the math in this article?
* How does math help us understand this news? It can be very helpful to ask students to make verbal comparisons or to draw a picture, diagram, table, or graph to represent their understanding of the math in the news story.
* What questions or wonderings do you have about this news or the math in this story?

When appropriate, ask extension questions such as:

* Can we make predictions based on the math in this news story?
* What is your reaction to this news?
* Are there other points of view that can be supported by these numbers or related information?
* Can you connect this news to other information you have learned?

Let's test-drive these questions using a simple news item from Scholastic News Online: [First Flute Found: Scientists Discover the World's Oldest Musical Instrument (July 8, 2009)](http://www2.scholastic.com/browse/article.jsp?id=3752155).

* *What's the main idea, and where's the math in this article?* An ancient flute that is 35,000-years-old was found in a German cave. (It was in 12 pieces. It is 8 inches long and has 5 finger holes.) Scientists found a 40,000 year old statue among other works of art in the same cave.
* *How does math help us understand this news? (Can we express in words or pictures what the numbers in this story really mean? Can we connect this math to other knowledge?)* The age of the artifacts helps us understand more about humans living long ago. 35,000-years-old is really old. The first pyramids of ancient Egypt were built less than 5,000 years ago and the wheel and writing were invented 5,500 years ago; this flute is 6 or 7 times older. It's older than the oldest cave paintings. (Relating these other events and constructing a timeline can help students grasp the antiquity of this flute.)
* *What questions or wonderings do you have about this news or the math in this news story?* \* How do scientists determine the age of artifacts? (This wondering can lead to a student-driven inquiry with more math connections.) \* Why were humans making instruments so long ago, long before they had even invented the wheel or writing?

The news story on the first flute is an example of "timeless news." It doesn't really matter when the news was reported. Years from now, this little article still will inspire awe, even when it's "old news." In the news resource section near the end of this article, explore headline news that might have enduring appeal or that might be adapted easily for use year after year. As you browse, jot down your own questions or wonderings.

You can use or adapt the printable [math news response page](http://www.educationworld.com/a_curr/mathchat/mathchat21_news_response_profdev.doc) with nearly any news article.

**HANDLING CHALLENGING MATH**

The math found in current news won't always mesh with the math skills of your students. What can you do when the math is too hard? We can use it as a teachable moment for demonstrating the usefulness of such math skills as rounding, estimating, and drawing pictures.

**Round and Estimate** Use place value concepts and estimation to help students work with large numbers in a news story. I wouldnt expect students to divide 35,000 by 5,500 to find out how many times older the flute is than the invention of the wheel. Instead, if we round to a "friendly number" (rounding down to 5,000 instead of rounding up to 6,000), we can compare 35,000 to 5,000. Because 5 x 7 = 35, we know that 5,000 x 7 = 35,000. Because 6,000 x 6 = 36,000, and 5,500 is halfway between 5,000 and 6,000, we can estimate that 35,000 years is about 6 times longer than 5,500 years.

**Draw a Picture** Drawing a picture, diagram, or graph also can help students make meaningful comparisons. In our study of election math, I reproduced circles divided into ten sections to help students set up pie graphs of polling data so they could visualize percentages as parts of a whole. My fourth-grade students were able to get a handle on some applied fifth grade math skills in that way.

**Use a Calculator** After making estimates, using a calculator to crunch the exact numbers in news articles is perfectly reasonable; it allows students to focus on the math concepts and applications even when the numbers themselves are daunting.

**THE VALUE OF CURRENT, CONNECTED MATH**

When students have regular exposure to math in the news, math becomes purposeful and the news becomes more accessible. Students begin to make bigger connections. They start to realize that "math is everywhere." They begin to pay more attention to current events and start to bring in news items their families have found meaningful. They begin to notice more ways that math figures into their daily lives. They begin to notice that math is used in validating every scientific study and they begin to wonder if perhaps math is science or science is math. They become more comfortable manipulating large numbers and stretching their math skills a bit. They develop higher-order thinking skills as they pose questions, synthesize information, and make predictions about the future based on statistics from the recent past. They become empowered mathematical thinkers!

**RESOURCES: A SAMPLING OF TIMELESS AND ADAPTABLE  NEWS STORIES**

**Math-Related News**

* [Largest Known Prime Number Found (9/29/08)](http://www.sciencenews.org/view/generic/id/36979/description/Largest_known_prime_number_found) The largest prime has nearly 13 million digits and was found through a cooperative computing project.
* [Mystery of the Shrinking Standard Kilogram (9/14/07)](http://news.softpedia.com/news/The-Mystery-of-the-Shrinking-Standard-Kilogram-65665.shtml) The reference kilogram used to set international standards has lost 50 micrograms in weight over the past 118 years compared to identical copies made at the same time, baffling scientists.

**Money Math**

* [Sale of 1 House Will Help 30 Villages (7/2/08)](http://www.cnn.com/2008/LIVING/wayoflife/07/02/hunger.house/index.html) A family hopes to sell its $1.8 million house and give half of the money to charity.
* [Ohio Boy Sells His Toys to Help His Family (7/20/09)](http://www.cnn.com/2009/US/07/20/ohio.boy.helps.family/index.html)

[Glitch Hits Visa Users with More than $23 Quadrillion Charge (7/15/09)](http://www.cnn.com/2009/US/07/15/quadrillion.dollar.glitch/index.html) One man's simple purchase at a gas station turns into a debt four times greater than the Gross Domestic Product.

**A Token Economy and Fifth Grade Financiers**

**By Cara Bafile**

"Because I work in a private school, parents have to pay tuition for students to attend," shares Beth Moore. "As the year goes on, students realize how much money their parents are putting into their education. A few students even have a true awakening to the sacrifices made on their behalf."

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| Students track deposits and expenditures. |

Moore's students come to that realization because being a fifth grader in her classroom isn't just an educational obligation, it's a paying gig. Like many other teachers, Moore incorporates economy into her behavior management system, but her approach, refined since her student teaching experience, is unique in its complexity and power to motivate.

"In our system, the kids learn about paper money, including checkbooks," Moore told Education World. "They have to apply for jobs as well as work their jobs. When a student is disruptive or not following procedures, he or she receives a fine."

**WORLD OF WORK**

Students are introduced to the behavior management system at the beginning of the school year. Moore relates their work as students to real-world jobs. They discuss homework, being respectful, helping others, and doing the right thing. Together, Moore and her students define a set of rules, or *laws,* for the classroom in order to have a successful year, and create a system of fines as consequences for breaking those rules.

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| Students are paid a weekly cash salary. |

Every year, the jobs students perform in order to earn their "pay" are based on a class theme. Last year's job titles were nautical in nature. This year's theme is space, so the jobs relate to roles on a space ship. Any task that can be completed by students is fair game -- passing out mail, handing out salaries, taking attendance, writing down assignments, delivering messages, managing recess equipment, holding doors, posting work on bulletin boards, and more. Moore's current class is so small that some jobs have been combined. "Salaries" for the various positions vary, but if students go above and beyond expectations, they might earn a bonus.

"Students like the fact that if they do their jobs, they get paid. They like paying for things, and they like to apply for different jobs," reported Moore. "They love to count out their money, and I think they actually enjoy filling out a checkbook too."

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| |  | | --- | | **Emerging Economy**  There’s no need to adopt all facets of a token economy such as Beth Moore's all at once. The fifth grade teacher recommends starting small with classroom jobs. Next, give students "salaries" for their work in the form of coins or classroom currency. The checkbook is another strong step.  For additional ideas, Moore suggests [The Ultimate Kids Money Book](http://www.amazon.com/Neale-Godfreys-Ultimate-Kids-Money/dp/0689817177) by Neal S. Godfrey, a resource she uses for her own program. | |

Admittedly, the fifth graders find it frustrating to lose some of their money to taxes, which are paid in the third quarter. They also don't care for paying into their savings, at least throughout the year. At the end of the year, however, when they get the money back, the students *love* it. Another fee the students dislike? Desk rental!

**A "FINE" IDEA**

Students appreciate that the system is consistent though. They understand well what to do and what not to do, and what to expect when they make poor choices. The fifth grade classroom has had some stiff penalties. Each day, the first fine is $5.00. As more fines are levied, the amount doubles. Moore instituted that policy because students struggle most with behavior issues at the end of the day.

"If I give out three fines, thats $5.00 for the first, $10.00 for the second, and $20.00 for the third," Moore explained. "Ive actually had it up to $320.00. It only took once for that to happen though. The student who had to pay the fine was really bummed and the rest of the class felt horrible."

Money thats collected through fines goes into a "kitty." Every two weeks, the names of all students who did not receive any fines during that period go into a drawing for the kitty.

Students are paid on a weekly basis. [Sacred Heart Elementary School](http://www.sacredheartfowler.org/School.html) is a Catholic school, so students pay a tithe; they also put money into their savings. Each amount is 10 percent, which students compute and remit with a handwritten "check." Moore holds those checks for reference.

**"MOORE" IN STORE** Each quarter, Moore's class operates a "store," where they sell things to one another, as well as to other students at the Fowler (Indiana) school. Moore provides other teachers with classroom cash to distribute as rewards one week prior to the sale. Fourth, fifth, and sixth graders participate in combined morning exercises, and Moore gives out her classroom money in the form of "Energizer Bunny" awards based on effort. Older and younger students receive $20.00 awards, but her students play a game in which the young students choose a hand and receive either a $1.00 or $100.00 bill. It is popular! The fifth graders love to sell items to the younger students.

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| A student writes a weekly check to "savings." |

"The students come up with an idea, advertise it, and then sell it on the day of the store," says Moore. "Some of my students work in groups and split the money. Some students have sold used books. Some have sold movie tickets they got a theater owner to donate. Some have made food products. Last year, some students raffled off an item, and some sold *mystery bags.* It was amazing."

At the end of the year, students calculate their total savings and place the amount in their checking accounts. During the last week of school, an auctioneer visits and students bid on items and "pay" for them.

Parents remark that they appreciate the emphasis Moore puts on saving, and note that the system encourages students to talk more with parents about their behavior in school.

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| Students make and sell goods in a school store." |

Sacred Heart fourth grade teacher, Beth Klinker, and sixth grade teacher, Gidget Master, have joined Moore in teaching aspects of economy. In fourth grade, students earn change and keep it in a piggy bank. Sixth graders are studying business and acting as "suppliers" for the fifth grade store. Theyve written and performed commercials, made order forms, and produced goods for Moore's class to sell. Most of those students are still in debt from the previous year and are working to pay back loans from their teacher.

"I really enjoy doing this and feel that if the students learn anything from the activity its that if you work hard, you will succeed," Moore added. "The anticipation that occurred last year was beyond my wildest dream. They were so excited to get to have a checkbook and earn money. They know it isn't real, but they are excited nonetheless."