

Writing in Math Class

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Writing is not a sure-fire way to help students understand or like math, but it does open lines of communication and helps to build a sense of community and trust so that students can take risks. It also gives students another way to look at math problems. Mathematics is, after all, communication, but communication in math involves a compact, unambiguous symbolism that to many students is cold and rigid. Writing, on the other hand, is a less structured way of expressing ideas. Since learning in math class depends on communication, I use writing mainly as a way of opening lines of communication.

Admit Slips

The first method I introduce is the **admit slip**. Admit slips give each student a channel to write something and to get an immediate audience. There is no wait for each student to see how his or her writing is accepted. There is also modeling because the students get to hear what their classmates have written. Everyone gets quick, class-wide responses.

Because I work with junior high students, I feel that I must put some constraints on them. The constraints are

nothing nasty,
nothing personal,
the slips are to be anonymous, and
everyone must write something.

Nasty can mean the scatological words and phrases so dear to junior high students, or anything that I feel may hurt someone's feelings, mine included. Personal messages are rejected so as to encourage messages of universal import. Slips that violate these rules are not read

aloud. Students write their own thoughts then fold the slips once. It takes two passes to pick up the slips. The first pass gets all but the most reticent started. The last couple are usually finished when I remind them that they're not writing the great American novel.

I then tell students to practice their listening skills. I shuffle the admit slips and have them cut before reading them to help to preserve anonymity.

Admit slips can give new students a chance to tell how they like it at this school.

When I first came to Woodbrook, I didn't think I would make any friends. I had a whole bunch of friends at Lockburn who I like being with, but the people at Woodbrook seem to be a whole lot nicer.

Or the students tell me how they feel about admit slips.

I have to admit that I really have nothing to admit. I have been a good girl. Very shocking . . . Last period was boring, and I hate having algebra last period because then I almost miss my bus.

Many of my students suffer from math anxiety. They have not been successful with math, and a page of numbers fills them with panic. Admit slips provide a comfortable arena to write about some of these fears.

I am having problems in algebra. One of which is I don't know how to do it. Although I am trying I'm not getting anywhere. I'm worried about my report card for this quarter.

Friday's algebra homework was hard.

Page 227 was hard.

Mr. Schmidt,
Can you explain 227 to me today?
Thanks.

I wish I understood my algebra.

Hi class,
Friday's algebra homework was too difficult for the average dumb student.
[Signed]
Dumb student.

It is difficult to give an objective measure of the effect that admit slips can have on math anxiety, but if students can share anonymously their successes and failures in the math exercises, they'll be able to deal with them better themselves. Admit slips let the students know that they are not alone in their fears and that they can celebrate successes.

Some students use their admit slips to share their successes with the class.

The test was pretty easy today. Thanks. Why are you so grouchy today? Hi.

Hurrah!
I GOT AN A ON THE TEST!

Yah, I got a
B-plus on the
test

HIP
HIP
HURRAH!

Algebra is getting a _____ of a lot easier, and I'm so happy and proud. And it's all because of my fantastic algebra teacher. Maybe not fantastic but I gotta give him some credit.

Life can be totally awesome! I have a pretty good grasp on algebra, because Mr. Schmidt is a very good teacher, even though he gets sarcastic, he's usually rather sharp!

Mr. Schmidt,
Pre-algebra is so easy. You should make it more difficult for some of us smart ones.

I've gotten used to this class so it is not as bad as it used to be!

Problems that can be verbalized can be discussed; they become something that can be attacked and handled. Sometimes a problem that comes on an admit slip will prompt a student with a related problem to see me before or after school.

Students also use admit slips to express their feelings about issues outside math class: their concerns about growing up, their difficult days.

Sometimes I wish I was little so I wouldn't have to worry about things like school, money, friends, and just plain old people.

Responsibility is a heavy burden and even though I'm still very young I dread growing up.

There is a guy in the class that I like, but he doesn't even notice me. But sometimes he acts like a nerd.

There will always be a Monday. This morning I woke up 10 minutes before the bus is supposed to come. The jeans I wanted to wear were wet. My dog got loose and ran all over the neighborhood and got picked up by the M.P.'s. My cat knocked over the aquarium, and I accidentally threw away my geometry.

The first admit slips are often tentative standard junior high buzz phrases, but once the trust and sense of community builds they be-

come more venturesome: mentioning math or computer successes. Often, they ask math questions or share puzzles:

Two algebra jokes.

1. When does $2 + 1 = 2$?

2. When does $12 + 1 = 1$?

answers: 1. 2 teaspoons of water and 1 teaspoon of sugar.

2. $12:00 + 1$ hour is $1:00$.

If you have five lines but have to make six spaces how would you do it?

answer: draw a star.

When computers were introduced in class and began to be used as problem-solving tools, students shared what computers mean in their lives:

Computers are fun to work with. I wish we were still using them in class.

I want to play the computers eat and sleep and hit my sister eat and sleep.

How about that, we got are selfs a TRS-80 home computer, it is neat.

I will be very happy when I get my Apple II computer with 2 Disk drives and an A.M. Desk Color T.V.

You know what makes me mad is when you have a computer and you can't use it until you mom sees you brought up your English grade and report cards don't get sent home until June 23rd.

When the class rings with "That's not fair!" as it did when I gave a cumulative algebra test to a prealgebra class, it is not easy to tell if the vocal ones are really expressing the feelings of the class. If I had listened to my accusers, I would have learned a different lesson than the one I learned when I asked students to write admit slips to tell me if they felt I was being unfair. Taking the time to write gives students a chance to reflect and maybe change their point of view.

In reading the paragraphs from the entire class, I could tell that many students did see the connection between the test problems in algebra and the things they had been trying to learn in prealgebra.

The math test I thought was a good idea. It helped me to see what I had to review before going into algebra next year. I don't think I did too well on the second and third pages, but now I know what to expect in algebra. How I can review all of it before going to high school.

The math test I took wasn't really hard. Some of the problems were sort of hard, but I still tried to work them out. It was a challenge. Most of the things in the test we've already learned from our prealgebra math book.

I thought the test was okay. It is only testing what you know. I knew how to do 50% of the problems. Others I guessed how to do, hoping to get them right. I hope to be able to get a good grade on this test so I can bring my grade up.

The first few problems of the test were easy. As I got further and further into the test it began to get harder. The test was fair. I wish every test was like that one. It was fair because if you didn't like your grade it wouldn't count but if you liked it you could keep it.

The algebra test was okay. If you think a student can do it let them. The first couple problems were okay. Like I said let them do it if they want to.

I thought that the test you were giving to us was going to be easy when I saw the first page, but when I got to number 22 the problems just started getting harder and harder. I did not understand how to figure out the rest of the test. So I had to make some educated guesses. I did not enjoy taking this test.

These admit slips gave students a chance to stop and consider what they had learned and how much there was for them to learn still. Because they use admit slips in so many ways, students begin to see math class as a place where feelings can be shared, and they can approach me for help without fear. Admit slips also make students more reflective about their own feelings.

Unsent Letter

Towards the end of the year I build on students' ability to reflect on their own language by assigning an **unsent letter**. I ask them to write to an imaginary cousin who is coming to Woodbrook Junior High and who will be in my class. The letter should tell the incoming student what she or he needs to know to get along in my class.

These letters are from an eighth grade math class in which students average two years behind their grade level on a standardized math achievement test.

Dear Nanci,

I got your letter and will tell you what you need to know to be a good student in Mr. Schmidt's class. He likes it when you bring pencils, your book and whatever else you might need. Be sure to bring everything you need before the bell rings. (Also be in your seat when the bell rings.) Mr. Schmidt does like to pick on people but he does it only to make people pay attention and do good in his class. I am really glad to have him as a math teacher. He will explain assignments, but sometimes he doesn't like to repeat him-

self. I can understand that. Well there's a lot more to say but I gotta go.

See ya soon,
Gladys

Dear Al,

I heard you are going to have Mr. Schmidt for math. He is sometimes nice and sometimes mean. He will yell at you if you do not bring your math book, pencil, and paper. If you are going to pass his class you have to do all the homework. You better listen when he talks to you. Sometimes when he is nice he lets you work on a computer.

Love,
Herman

The lesson that is repeated in almost every letter is that students need to bring books, paper, and pencil and that to learn in class, it is necessary to do the homework. That is a different attitude than they start the class with. It is a step toward accepting the responsibility for their own learning.

Admit slips have made the students realize that their feelings and concerns about school do have an audience and value. One unsent letter assignment gave them an opportunity to share their feelings about school with a student who has been taught at home by a computer teacher and who has no chance of peer contact.

The students wrote to a girl in a Ray Bradbury short story. Here is a short synopsis of the story: In the twenty-second century Margie is upset with her computer. She finds an ancient twentieth-century book, and she longs to be in a school with real kids and human teachers instead of at home alone with her computer teacher. These unsent letters give students an opportunity to analyze their feelings about school.

Margie,

I think you would enjoy the twentieth century school system. The teachers are real human beings and know and understand feelings, and they sometimes get to be real nice friends.

I personally enjoy school the way it is, and I don't think I could live with having a computer for a teacher. I wish you could experience a twentieth century school day, even if it is just one day.

Friends forever,
Jim

Margie,

Hi! My name is Rorie Alfaro and I was wondering if I could be your new friend.

I am in my math class called algebra. I have a man teacher and his name is Mr. Schmidt. I think you would like going to a school

because you get to meet a lot of people and when you're in a regular school, if you don't understand a problem a teacher could probably help you better than a computer.

We have six classes a day and then they are called periods. In the morning when I wake up I eat, etc. When I come to school I go to my locker and get my books. My books are for me to learn from, it's something like your teacher.

Got to go now. I'll write more after.

Friends,
Rorie

Margie,

Howdy! You asked me earlier, "What is my school like?" Well, I think it's kind of hard to explain my type of school.

Unlike yours, we go to different classes for different subjects (assuming you're in 7-12 grade.) The teachers are human, and they all have different personalities.

It really is fun. You have time between classes to visit with your friends and a certain amount of time to eat lunch.

In each class you hand in your homework, the teacher explains the next lesson, he asks you some questions on that particular lesson or subject. And towards the end of the period, you're usually assigned some homework.

It sounds as if your school is only 2 or 3 hours long. Well, you're really lucky ours lasts about 6 hours.

I have to admit the school of the future sounds boring. I wouldn't want to be taught in my own home and by a computer.

Well I gotta go. See you around.

Friends,
Shaunna

Dear Margie,

I am in the 20th century, the year 1983 and I am in school right now not your school of course. I am in a public school in the Clover Park School District. That means all the kids that live in a certain area near here come to this school.

The schools here are probably funner than the ones there. Here all the kids come and gather at school at 8:55 a.m. At school we have different teachers to teach different things and it's great! I know you have computers now we do too. Probably not as advanced and as good but we have them. I'm sitting at one right now in my math class.

Well I have to go now it is time to go home for the day.

Signed,
Dan

Dear Margie,

School in this time is mostly like it is in your time, we have computers, homework, and teachers except our teachers are human unlike yours which is a computer. But it's mostly the same. I would

trade yours at times if that were possible, because I think I would like being able to stay home and pick the times I wanted to go to school.

Your friend,
Dale

Teaching is not a good way to get rich. The rewards come from human contact. Once communication has been opened between my students and me by admit slips, I sometimes get unsolicited letters from students. Some are little notes attached to homework and some are lengthy explanations.

Mr. Schmidt, I understand this pretty well, I just made careless mistakes.

I will turn in p. 306–9 late on Monday.

Mr. Schmidt—I think I understand better now.

I figured out what I did wrong.

Mr. Schmidt—This assignment was pretty easy. See ya.

Mr. Schmidt—I only worked for 30 minutes on this because I had a lot of homework. I understand it a lot better now.

Some answers I didn't reduce until I saw the answers in the back of the book.

I know what I did wrong.

Mr. Schmidt, I think I understand this pretty well, but I need more practice on it.

Mr. Schmidt, I understand this okay, but I don't know how to change the equations to the right form.

I think the following three letters, even though very different in tone, are a result of the lines of communication that admit slips have opened up and that the unsent letters have strengthened. The students sometimes write me about the concerns they have and we can discuss them as a class if they are concerns that may affect everyone (like the letter from "anonymous"). An atmosphere where concerns can be discussed seems to mean there are fewer students who sit there not knowing what to do except stop trying when things aren't going smoothly.

Mr. Schmidt,

I spent a lot of time on this assignment. My mistakes were all on the 4th step. I didn't change or I had an equal number in the beginning. I understand this very well though.

Mr. Schmidt,

I'm a concerned student. I feel you are not doing your duty in explaining our tests and assignments. For instance, it is very hard to

take a computer test when you haven't even corrected your assignments before that. I feel that one of the reasons I got a lower grade on the test was because I was not informed of the correct answers on the assignments. After we got the test back, we never even went over it. Instead of keeping the wrong answers from the test in mind, I would like to learn something by knowing the right answers.

Another example is that you give us the assignments at the end of the period so that when we do a problem and need help, it's too late.

This is not to be a rude note, but I am honestly concerned with the welfare of my fellow students and I.

Sincerely,
Anonymous

To: Mr. Schmidt,

I am very proud of myself. I did what you said: If you don't understand something try and figure it out yourself. So that's what I did. I've been lost since p. 166 and haven't tried to figure it out so yesterday I did just that.

I figured out how to do pages 166–191 so I'm not lost anymore.

Here are all those assignment. I've finished all of them except 176. I didn't understand that page no matter how hard I tried. I would like to take the tests for these pages Thursday after school if you're not busy.

Now I am caught up and can do the next chapter.

Thank you for offering your help. But now I think I understand what I didn't earlier.

Sincerely,
Beth

P.S. From now on I will try harder and will also try to get my assignments in on time.

Dialectic

Not only do students use writing to deal with their feelings about math, they also use writing to explain problems to themselves. When Beth says that she was able to figure things out for herself, she is referring to a process of writing about the math problems which stumped her. Like many students, she is not a good number cruncher and finds $2x + 7 = 9$ strange and frightening. It is easier for her to put such problems into words such as "seven more than twice a number is nine." I encourage students to use writing to explain math to themselves and remind them that they learned words before they learned numbers as children. This process of writing about math problems resembles the **dialectic** described in other chapters of this book, but in-

stead of recorded notes on the left side, students put numbers on the left and then write their explanations on the right.

Book Reports

Even when they write to express feelings and to learn math, some students still cannot succeed in my course. With another form of writing I offer my students an opportunity for success: I allow them to write book reports.

“Book reports in math?” “Read a book about math?” These are the usual responses writing book reports in a math class bring. When I took math, I never considered it a human discovery, but through my reading I’ve learned about the people who invented math: humans with foibles like the rest of us. Reading about these people and their inventions has heightened my interest in math, and it seems to do the same for my students.

I’ve gleaned all of these delightful esoteric facts from reading junior high math books:

Rene Descartes who invented, along with Fermat, graphing on the Cartesian plane had to move secretly from place to place because he was so popular that was the only way he would escape the society that sprang up around him.

Pascal gave up math to devote all his energy to worship God, but when he got relief from toothache pain while working on a math problem, he took that as a sign from God that working that problem was okay. When the pain left, his asceticism again stretched to math, and he again gave it up as others give up smoking for Lent.

A googol, 1 followed by 100 zeroes, was invented by the son of a physicist to name his concept of a BIG number. A googolplex, 1 followed by a googol zeroes (ten to the googolpower) makes a bigger number.

Decimal fractions were invented in 1585. While fractions were used in ancient Egypt.

There are infinitely many counting numbers, an equal number of fractions or even numbers but somehow there are infinitely many more nonrepeating decimals (irrational numbers).

Hypatia, an accomplished mathematician, philosopher, beautiful woman, and pagan was stripped naked, dragged through the streets and had her flesh stripped from her bones by those professing to be Christians.

There is also a delightful mathematical analysis of why an elephant can't jump as high as a flea.

Men and women invented calculus, zero, multiplying logarithms, even methods of determining "pi" to as many decimal places as you like.

Eratosthenes, again of Alexandria, measured the diameter of the earth quite accurately using trigonometric ratios before Christ's birth.

It's good for students to realize that mathematics is part of their human heritage.

The report must be on a book with Dewey decimal classification numbers 510, 793, or 001.64. It is further to be on a book the students enjoy reading. The specific directions follow.

1. Write it in ink at least one page long but no longer than two pages.
2. Give the title of the book, the author, and the number of pages.
3. Tell what the book is about.
4. Tell what you learned by reading the book.
5. Tell what you like about the book.
6. Tell what you didn't like about the book.

The book report format asks the students to exercise their judgment about the book, thereby telling them that their judgment is important. Rarely do they fail to find something that they like about a book, especially since the students have the responsibility of searching through the books to find one they'll enjoy reading.

Here are some examples of student reports.

Ricky
Period 4
Mr. Schmidt

The name of my book is Computers:Machines with a memory, by Doris and Stephen Kinsler and it is 54 pages long. A computer has 5 main parts: the control unit, the arithmetic unit, memory devices, and input and output devices. The control unit interprets and carries out the instructions of the program, and it also controls the input and output devices. The arithmetic unit does arithmetic problems such as addition, subtraction, multiplication and division, also logical problems such as comparison of 2 letters, numbers, or symbols. All the information the computer will work with must be put in its memory, the storing place for information. What someone puts in the computer is input, and what the computer gives back is output. I learned what a computer is made of and how it works. I liked how clearly it explained everything in this book. You know as well as I do I don't like math, but I did think this book was interesting.

Not all students like math, yet Ricky did read a book and learned from it about computers. Ricky says he doesn't like math, but he found the book interesting and presenting a clear idea about how computers work. Students often look for someone to blame when they don't learn, but now Ricky knows that he can learn about math by reading and that the responsibility for what he learns lies with him as well as the teacher.

Duane Linker
Geometry
Period 4

The Age of Mathematics—Volume I
(The Origins)
Author—Michael Moffett
133 pages

The Origins is the first book of a four book collection which covers the history of mathematics. This book explains how mathematics was developed in many different regions of the earth. After reading this book I realize how complicated the number system could be if we didn't have our system of counting. I used to think also that our system of numbers was the best anyone would ever think of but now it seems there are ways our system can be improved too.

What I liked about this book is that it made me realize how important math was long ago and even now. If we didn't have math and a number system almost everything in our society would be impossible such as space travel, cars, computers, designing things, etc.

Duane is beginning to see how mathematics fits in with human history and to understand the role math plays in a liberal education. Duane has begun to see that mathematics has evolved and changed and that these changes have made a difference in his life in that it is easier to use math now because of the changes made long ago.

Teresa Zimmers
Geometry p. 4
June 3, 1983

THE HUMAN SIDE OF COMPUTERS
by Daniel Cohen
82 pages

The Human Side of Computers is an "attempt at a balanced view of computers, how they affect our lives, and our attitudes toward them." Since many people become very emotional about computers, because they fear their impact, this book tackles some of the questions the American society has about computers: do computers constitute a threat to our society? What steps can be taken to ease the threat? Is increasing computerization of society good? Is it inevitable? These problems bother most everybody, and they are discussed in this book.

The book also discussed reasons people resent computers, computers and crimes, polling and politics, computers at war, fun and games, privacy, artificial intelligence, and all humanizing computers. Those incidentally are the names of the chapters.

I liked this book because these questions are ones I have been wondering about. So much of our society is based on computers, from businesses to the CIA.

I would recommend this book to junior high students because it is written in our technical terms about the concerns of today's society.

Teresa is learning about the consequences of computers for society. She shows a more reflective view than the admit slip students who want to "play" on the computer in class or at home.

Summary

I'm amazed sometimes how far written communication can go and how rewarding it can be. The following are examples of the kind of notes I have received on assignments.

To Mr. Schmidt,

I know I'm not a very good student as far as grades are concerned and I'm sorry. I will miss you a lot. You're one of the best teachers I know. I really enjoyed having you as a teacher.

Love,
Sue

P.S. Have a very happy life and I hope everything you do turns out for the best.

Mr. Schmidt,

No, I'm not mad at you, my parents are getting a divorce, and I don't feel good. Thank you for caring.

Buffy

Writing in math class is not a panacea. Students still fail—there hasn't been a test yet where every student got a perfect score. Much of the writing isn't even about math. Still, by learning and writing about related topics, by writing about problems which puzzle them, by writing about their fears and feelings, students begin to see math in more human terms. For me it is a way to get to know more about those varied and wonderful people who are my students. Thinking about how I use writing to learn in math classes I've become aware that what I do would work equally well in a shop, home economics, or English class.

I feel that writing gives students more of a chance to communicate feelings about a subject or to tell a teacher they need more feedback. The teacher-student connection is one of communication, and writing can help to make that communication two-way.