

# **WRITING and MATHEMATICS INSTRUCTION— A Great Combination**

By Lynn Havens

I recently had a conversation with a colleague in Florida about incorporating CRISS (CReating Independence through Student-owned Strategies) learning strategies into secondary classrooms. One of her many hats involves providing in-service in learning strategies to middle and high school teachers. She shared with me a frustration that she continues to have from in-service to in-service -- the majority of the mathematics teachers with whom she deals can't see "what's in it for them." She cautiously confided this to me knowing that I taught junior and senior high math for eleven years before taking my current position as director of the CRISS program.

As we visited, I told her about a classroom research project I recently completed with a 7th grade pre-algebra class, in which I incorporated writing strategies into daily instruction. Since many of you may have the same "math teacher frustration", I thought this might be a good place to share my project. I am truly convinced that all math teachers should use writing as a key part of their instruction.

Holly, a 7th grade pre-algebra and general math teacher in our district, graciously let me use one of her pre-algebra classes for my research. When I worked with Holly, her building was on a modified block schedule, so our weekly schedule included two days of 50 minute periods, Monday and Friday, and two days of 76 minute periods, Tuesday and Wednesday. The students did not have pre-algebra on Thursday. We were excited to see how writing would fit into this schedule.

I watched Holly for a few days before we team taught, because I did not want to disrupt her daily teaching routine. What I observed was typical of most math teachers. She started class with a warm-up exercise she had posted on the board before the students arrived. This was usually a calculation problem, either a numerical or word problem based on information from the previous day's lesson. Next, she, or students in class, read the answers for the homework, and they corrected their own work. She answered questions and worked problems for students who had trouble with the assignment. After that, she explained the new material, and students spent the remainder of the period completing their next day's homework.

My plan was to integrate four types of short, informal, and non-graded writing assignments into her regular routine. The purpose of the writing was to help students be metacognitive and to help them to look at writing as a way to improve their comprehension and retention of mathematics concepts.

## **The Warm-up Activity**

Since Holly began each class with a warm-up, we just changed the task to a writing prompt. On Wednesday, I observed Holly's lesson on calculating the percent of change. Friday was the next class day in their schedule, so their warm-up prompt was: When you are given two numbers to figure a percent of change (such as 20 to 15), how do you know if it is a decrease or an increase? The students were given about five minutes for their response. On this day, when the students

were done with the warm-up, several read their responses. If students' entries were wrong or incomplete, I asked them questions or had them give examples to clarify what they had written, I suggested that they add that type of information to future entries.

On the following Monday, I made copies of several entries and talked about how they addressed the prompt. For example, one response was: "you look at the two numbers if the second one is bigger then its an increase." My comment was, "This helps me. I can look at the two numbers, and if the second one is larger, then I know I have an increase. I guess if the second is not larger, say, for example, the two numbers are the same size, then I have a decrease." Hands shot up to tell me that I was wrong. The second number had to be smaller to be a decrease. They decided that the answer would be better if both parts were included. Next, I showed a response that I thought was particularly good. "When you are figuring a percent of change you have to look at the two numbers that are given. If the second number is bigger than the first then you have an increase. If the second number is smaller than the first you have a decrease. Like 20 to 15 is a 25% decrease and 10 to 15 is a 50% increase." I told them having an example helped me understand what the student author meant.

Throughout the unit, I continued to have two or three students read their responses each day, and I showed selected examples the following day. Usually these responses were well done, but occasionally I threw in one that was wrong or incomplete, so we could talk about what was wrong and how to make it better. I kept track of which student's good examples I used to make sure that each student was "published" at least once.

### **Homework Corrections**

On the following Monday, I had the students do their first writing assignment over their homework. I had Holly quickly read through the correct answers. As she read them, she also wrote them on the overhead, and the students wrote the correct answer next to any problem they missed. I put the instructions for this writing assignment on the overhead:

On the following Monday, I had the students do their first writing assignment over their homework. I had Holly quickly read through the correct answers. As she read them, she also wrote them on the overhead, and the students wrote the correct answer next to any problem they missed. I put the instructions for this writing assignment on the overhead:

Pick one problem you missed. Look back at the problem in the book, the correct answer, and your work. See if you can determine what you did wrong. Write out in words your error(s) and how to redo the problem correctly.

I gave the students about 10 minutes to respond. Holly and I circulated while they were writing and reminded them about rechecking the book and recalculating the answer. We did not tell them what they did wrong. If all else failed, we allowed them to write that they could not figure out what they did wrong.

Holly was uncomfortable with this assignment, because it took a lot of time. She was afraid she wouldn't have enough time to go over the problems the students missed, as this usually took quite a bit of her class time. Interestingly, however, we found that students were able to answer most of their questions when they were given the time to look back and figure out what they did

wrong. As with the warm-up exercise, I copied their responses to an overhead and shared them the following day. I chose the response shown below to share because nearly everyone in the class missed that problem.

#22. \$120.00 increased to \$240.00 Student response: Answer: 200%. I thought that since  $120 \times 2 = 240$  that the increase would be 200%, but I only needed to increase it by 100% to get it twice as big. The answer should be 100%.

That student response identified why the student made the error. The student also included why the correct answer made sense. I could "see" the student's reasoning, and so could the student.

### **Word Problems**

On the days when we had the block periods, we had more time and decided to let the students be creative and develop their own word problems. Their first problem was given as a warm-up. It had to involve a markup, and the answer to their problem had to be \$20.00. Since they had done some markup and discount word problems on the previous day's homework, I did not model prior to their writing. I directed them to look back at the book to see how the text author wrote the problems.

### **Student Responses**

A football went on sale for \$16.00. When the sale was over it was marked up by 25%. What would the final cost be?

A book costs  $x$  amount. Then it is marked up 20% to equal \$24.00. What was the original price?

When I shared the responses, I asked some of the students to explain how they figured out which numbers to use in order to get \$20.00 for the answer. We talked about the importance of thinking through the problem before starting to write. I explained that good writers in all content areas usually have a plan before they start writing. I also talked to them about adding more details or creating a personal situation, so their problems would be more interesting than those we read in the text.

The following are some word problems assigned a few days later. These deal with selling a house and a realtor's commission. The students were asked to show their solutions.

### **Student Responses**

When I first moved to Kalispell, my parents found a house for sale that cost \$105,000.00. The owner's agent got 6.5% commission off the price. How much commission did the agent get?

Ans.: \$6,825.00.

$c = 6.5\%$  of 105,000

$= .065 \times 105,000$

$= 6,825$

A house on an island on Flathead Lake with 360 ft. lake front and five private acres is selling for \$1,540,000.00. The realtor's commission is 3%. How much money would the seller get after the realtor sells it.

Ans.: \$1,493,800.00  $1,540,000 \times .03 = 46,200$   $1,540,000 - 46,200$

$= \$1,493,800$

Students were starting to be more creative and getting some enjoyment from their writing. I never had a shortage of volunteers to read their own word problems.

### **Explanations**

The writing assignments that dealt with explanations usually involved vocabulary terms or concepts. I used these assignments to help the students and me identify whether they understood the concept or not.

Students wrote explanations right before doing homework problems involving a concept. An example of this follows using the concept of simple interest. After this student example is another from the same student the following day when I assigned a similar explanation assignment as a warm-up. Comparing these two responses for the same student lets us know if applying the concept through homework practice improved the student's understanding.

### **WRITING BEFORE DOING HOMEWORK**

What does it mean to take out a simple interest loan?

What it means to take out a simple interest loan is that you go to a bank, borrow money, and the bank charges interest for how long it takes you to give it back. It's quite simple.

### **WARM UP**

How would a banker explain simple interest to a customer wanting a loan?

"When you take out a loan here at First Interstate, we charge you simple interest for our time and effort. When you take out a loan we are going to take say 12% of that loan and add it to the loan. The more time we give you the more interest we collect. If you have a 2 year loan we add that 12% twice."

### **Conclusions**

Holly and I found that it was difficult to give the time we wanted to writing activities on Mondays and Fridays, when we had shorter days, 50 minutes. If we did both the warm-up entry and the homework entry, we didn't have much time for students to get started with homework in class. I might have dealt with this problem by giving shorter homework assignments, but Holly had two pre-algebra classes, and she didn't want to give each a different assignment.

We found writing to be a great change of pace in the block classes. Even the students mentioned how quickly those days went by. Generally, our 76 minute period went like this: students wrote on the warm-up prompt (10-15 minutes), we corrected homework (5 minutes), students analyzed mistakes (5-10 minutes), teacher/student talk on homework (5-10 minutes), we introduced new material through "strategies" [reading, discussing, teacher-talk, hands-on] (10-20 minutes), students wrote explanations (5-10 minutes), class work time (15-20 minutes).

Finally, at the end of the project, we asked the students about writing in mathematics. I found it interesting that when asked how they felt about writing, the class average showed "it was O.K." And yet, when they were asked if writing helped them better understand the information in the percent unit, seventeen answered "yes", one wrote in "maybe", and two said "no."

Their comments were exactly what we had hoped to hear:  
It made me think more about the problem and how to do it.

I was confused on some things until I wrote them out.  
I like knowing not only the formulas, but what they mean.  
It helped me understand what I was doing wrong.

This study lasted only a few weeks and covered only one chapter in a pre-algebra text, and yet I feel that we started to get one class more involved in the language of mathematics and problem solving.

*About the Author: Lynn Havens is currently Director of Project CRISS. Prior to her involvement with the project, Lynn was a junior and senior high school mathematics and science teacher with the Kalispell, Montana, Public Schools.*

NOTE: All material is copyrighted. Permission is granted to photocopy or print this article in its entirety, as long as all credits remain intact with the article and the Project CRISS® copyright appears on the materials. This article may not be used in any other publication in any medium, without the express, written permission of Project CRISS®.

©Project CRISS