# PROCESS NOTES FOR MATH CLASS

By Sally Hunt

Students seldom realize that they use *processes* daily to achieve desired results in life. They seem to think they get from one point to another by random acts or maybe just by luck! To introduce the idea of processes or routines in life, students can talk about some of their basic "routines" such as getting dressed in the morning, getting to school, etc. A fun way to demonstrate the importance of clearly communicating a process is to bring a loaf of bread and a jar of peanut butter into the classroom, have the students write the steps to make a peanut butter sandwich, and then you carefully follow their directions to create a sandwich. Usually, students forget some critical steps like, "*Remove* two slices of bread from the package". or "Use a *knife* to scoop out some peanut butter from the jar".

In math, perhaps more than in other content areas, processes are very important. In this article, I will share two ways I have worked with my students to increase their understanding and application of problem solving processes. First, I will describe *mathematical process notes* which help students solve many types of problems, including computation (adding, subtracting, multiplying, and dividing whole numbers, decimals, or fractions), graphing equations, and writing proofs in geometry. Next, I will share the secret of how I finally got my students to read and work word problems using *word problem process notes.*

## Mathematical Process Notes

After observing a colleague, Bridget McCoy, successfully use process notes for learning logs in a ninth grade dropout prevention class, I developed a two-column process note format for my math students (*Figure B-1*). I found that this organizer not only helped my students solve math problems, but it helped them incorporate the language of mathematics. In addition, I found that the depth of their understanding increased, as well.

## Using Mathematical Process Notes

So students can become familiar with the organizer, I start by using a problem and process with which they are familiar. The sample problem in *Figure B-1* would be appropriate for most middle school and high school students.

1. Begin modeling by working the given problem in the first "Process" box. Get input from your students by asking the following questions:

   "What do we have to do first to work this problem?" *(Find a common denominator.)*

   "What is the least common denominator?" *(12)*

   "How do we know that?" *(12 is the lowest number that both 3 and 4 will divide into evenly* OR *3 times 4 is 12* OR *if we count by 3's and then by 4's, 12 is the first time the multiples are the same or any similar answer.)*

   "How do we change these fractions to equivalent fractions with a common denominator of 12?" *(Divide the first denominator into 12….)*

   Continue through the process with similar questions. It is important to use correct terminology and to be as verbally clear and concise as possible. Be sure that students know the meaning of the terms being used. Repeat these key terms frequently, so the students will hear and remember them.

2. Next, ask the students to describe exactly what was done and place this information in the second "Process" box. Hopefully, the verbalization from the first part will aid them in this process. They must use correct terminology and be as precise as possible when explaining the process they used to solve the original problem. For instance, their response could begin, "First, we had to find a common denominator. It was 12

| Problem | Process |
|---|---|
| [sample problem] Add $\frac{2}{3} + \frac{3}{4}$ | |
| Describe exactly what you did. Be as clear as possible. | |
| Write directions for adding any two fractions with unlike denominators. | |

***Figure B-1***

because it is the lowest number that 3 and 4 will both divide into evenly. Then, we had to change the two fractions to equivalent fractions with a denominator of 12. We did this by…" When they have finished, have some of the students share in small groups and/or with the whole class to be sure they all see and hear correct answers.

3. During the next step, the students really begin to make meaning. Ask the students to write the entire process for adding fractions with unlike denominators, being non-number specific. In other words, they are to write a generic set of rules to solve this type of problem step by step. They should do this individually. *[Note: You should establish parameters in advance as to what knowledge they can bring with them and which steps must be written.]*
4. When they are finished, ask them to exchange papers with a partner. You should determine in advance with whom they will swap. At this time, there is generally panic with statements such as "I didn't know anybody else was going to read this!"
5. Display *Figure B-2* and tell the students they can use *only* the directions that their partner has written—not their own background knowledge. (You may have to remind them of the parameters established in #3 above.) If they cannot solve the new problem, they must give the rules back to the author to rewrite. The excitement (and noise) level peaks about midway during this part. Give students time to revise directions, complete the problem, and verify the answer. Expect partners to exchange papers several times before directions are complete and the problem can be successfully solved.
6. Have the students discuss what they accomplished in addition to just working the problem. Hopefully, they will see that they now have process notes which they can use in the future to solve this type of problem. Encourage them to keep these process notes in their notebooks, so if they have difficulty solving a similar type of problem later, they can refer to their rules and be independently successful. In addition to creating a "process" they can follow in the future, they will have a better understanding of the concept(s) involved.

**Word Problem Process Notes**

Another application for process notes, that I found to be very valuable, is helping students solve the *dreaded* word problem. It seems that even the "best" students do not want to or are unable to work word problems. Students that

Using ***only*** your partner's directions, work the following problem.

$$\frac{4}{5} \times \frac{5}{6}$$

***Figure B-2***

are very verbal and able to read on a high level in other classes will come into math class, and they cannot read or comprehend a word.

All my students had a hard time breaking down the information from word problems – they wanted to look at a problem and be able to work it in one step. Naturally, this led to frustration and complete dislike for word problems. This was unfortunate, because with word problems, the real application of mathematics takes place. Nothing I did motivated my students to do word problems until I developed *Word Problem Process Notes, Figure B-3*.

In the following example, I have adapted the format for an algebra word problem. The step which asks the students to "identify the variable" may be omitted when this organizer is used with other students

**Using Word Problem Process Notes**

1. Give students a blank copy of the *Word Problem Process Notes*, or they can copy it on their homework paper to accommodate each problem. Begin by modeling on the overhead or board, with input from the students. You should work through one example of each type of problem to be assigned. The students should follow along and complete the process notes in their notebooks.
2. Next, give the students one sample problem of each type found in their assignment. Let them work in pairs or small groups to solve, while you facilitate and guide their thinking.
3. When they have successfully completed this, they can be given the homework assignment. Expect that students will reach this point at different times. As you are monitoring the group work, you will be able to identify which students are struggling more than the others and provide necessary guidance.

In *Figure B-3*, which follows, I have included the process notes used to solve a ratio problem from Glencoe's *Algebra 1, Integration, Applications, Connections*, 2000.

***Problem*** (page 199, #37): **Movies.** When rating movies, movie critic Ms. Taylor gives four thumbs up to every five thumbs up given by movie critic Mr. Leshnock. If Ms. Taylor gives thumbs up to 68 movies, how many movies does Mr. Leshnock rate favorably?

Using this format and process gives the students a visible target – they know what is expected of them, and it enables them to do word problems independently. Because they have at least two examples of each type of problem to follow when they start on their homework (which could be many hours after they leave class), usually they can be successful. I required that all word problems must follow this two-column format. Even on tests, they had to work the word problems in this form.

This process takes a little more time and effort, so I did not assign my students as many problems as in the past. To have ten word problems worked correctly, rather than fifteen or more problems half done or not done at all, was a triumph for both me and my students. Finally, my students were successful with word problems!

I hope you can use and/or adapt the two process note formats I have shared with you. Once you have used these two-column formats with your students, you may be surprised, as I was, to see your students adapting the process note format for different problem solving situations. As always with CRISS, student ownership is our goal. I think both you and your students will be pleased with the success you experience.

NOTE: Figure B-3, Word Problem Process Notes, follows this article on page 4.

*Sally Hunt is retired from teaching. However, prior to her retirement, Sally worked 13 years for the Pinellas County School Board in Largo, FL, 11 years as a math teacher and 2 years as a district CRISS trainer. Her classroom experience includes 4 years of teaching fourth, fifth, and sixth grade math and science; 3 years of high school math, science, and Spanish; and 11 years of teaching middle school math.*

## WORD PROBLEM PROCESS NOTES

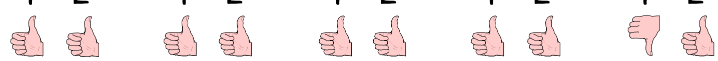
| | |
|---|---|
| **Write** the question. | How many movies does Mr. Leshnock rate favorably? |
| **List** clue words and facts. | **Clue words:** "four thumbs up to every five" - indicates a ratio.<br>**Fact:** Ms. Taylor gives 68 thumbs up. |
| **Identify** the variable(s). | T = Number of Ms. Taylor thumbs up<br>L = Number of Mr. Leshnock thumbs up |
| **Make** a drawing. | **Movies** 1 2 3 4 5<br>T L T L T L T L T L<br> |
| **Choose** a strategy. | Set up a ratio of favorable Ms. T. picks to favorable Mr. L. picks. Solve by using the product of the means equals the product of the extremes. |
| **Solve** the problem. | $\frac{T}{L} = \frac{4}{5} = \frac{68}{L}$, $4L = 5 \times 68$ *means = extremes* [cross products]<br>$L = \frac{340}{4}$ *divide by 4*<br>$L = 85$ *simplify* |
| **Write** your answer in a complete sentence that answers the question. | Mr. Leshnock rates 85 movies favorably. |
| **Check**<br>Credibility (Does your answer make sense?)<br><br>Mathematical | **Credibility:** The answer makes sense, since Mr. L.. would rate one-fourth more movies favorably than Ms. T. would.<br><br>**Mathematical:**<br>$\frac{68}{85} = .8$ which is the same as $\frac{8}{10}$ or $\frac{4}{5}$ |

***Figure B-3***

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