Sixes

Name Ms. Salter-Mac

1. **Continue the number pattern...** 102, 108, 114
120, 126, 132, 138, 144, 150, 156, 162, 168, 174, 180
186, 192, 198, 204, 210, 216, 222, 228

2. **In the ones place...**
it will go 2, 4, 8, 0 and keep on repeating.

3. **In the tens place...** you cant far tens, you will stop at an odd number and it will go back to even to make a pattern. Stops 1, 4, 7, 0
00 22 33 55 66 88 99

4. **Odd/Even**
Six is an even number. In the ones place all multiples of six are even. It takes two odd numbers of three to equal an even number of six.

5. **Six is ...** Saturday, a school start, an age of teeth half a dozen.

6. **On the hundreds chart...**
There are five blanks between each 6 multiple. It has a pattern of one in the first raw across, two in the second and third and then one in the farth. The diagonals skip so it looks like a checterboard.
Second + eigth colom tens begin with same numbers in tens place

7. **I discovered ...**
Sixths Tenth colom down begin with 3, 6 + 9 all multiples and divisions of six.
All multiples are even.

Belinda Cano

109

Class

1. I think that math is pressit of lazy ness because people work on math and see what it means.

2. I learned that you could multiply with a dimond metoed and you still get the same answer. We learned fractions can be used for a less number to dived not the. We learned divon can be multiplied by a big number to

Melissa

① you don't have to make every thing hard. You find easy ways to multiply, divide and other things

② this year I learned the coret way to diveid and Multiply. I learned easyer was to do Stuff like be origanzied and how important it is

Expressive Writing

What I Can Say About A Million

(4)

Tammy Moran

Before we started our million project I thought a million had eight zeroes. I would not want to count a million piece of rice piece by piece because it would take 25.5 days. A million looks more than I expected. I have learned that 11 increments only holds about 100,000 grains of rice! I observed that a 1 ounce cup only holds about 1699 grains of rice! I figured out it takes 588.5e153 1 ounce cups to get a million pieces of rice by dividing 1699 into 1 million. I also learned a million is less than a billion. If you divide 1699 into 1 million it is much shorter and efficient than to count a million pieces of rice. The relationship between 10, 100, 1000, ect. is that you keep adding 0. I was suprised by how much it took to equal a million by how much space a million takes up. I think it would be easier to count something bigger because it would be harder to skip some.

1. The boy started with a dollor. = $1.00

2. He traded for 2 quarters, = $.50

3. Then he traded for 3 dimes = $.30

4. Next he traded for 4 nickels = $.20

5. Finally he traded for 5 pennies = $.05

Was the boy in the story smart or foolish? Tell why.

I think he was very foolish because everytime he got money he would lose more money.

Journals are...

✓An ongoing record

✓Provide reflections

Components of a Journal

- ✓ Table of Contents
- ✓ Pages numbered
- ✓ Entries dated and labeled

One day, I was coming home on the school bus and everything seemed like a math problem. How many people get on the school bus? How fast will I have to do my homework to still have time for supper and soccer practice?

Then I thought if I do my homework for 2 and a half hours, eat my supper in 15 minutes and drive to Fair Oaks in 10 minutes. I would wait 10 more minutes for practice to start. Then I would have to get home from school at 3:50.

The next day was worse. First, my friend wore a medal. How much medals would there be if everyone wore a medal but me, our class has 21 students? It got worse. Someone flipped their eye lids over. How many eye lids would be flipped if our entire class flipped both of their eye lids over? I tried to stop myself but I couldn't. Then someone in another class wore one earring on an ear. How many earrings would be worn, in my class, if everyone wore an earring on one ear?

a.23
b.22
c.21

That was not all. If I got home at 3:50 and do my homework for 2 hours, and play outside for 10 minutes, eat for 15 minutes, would I be late for P.S.R., which is at 6:30?

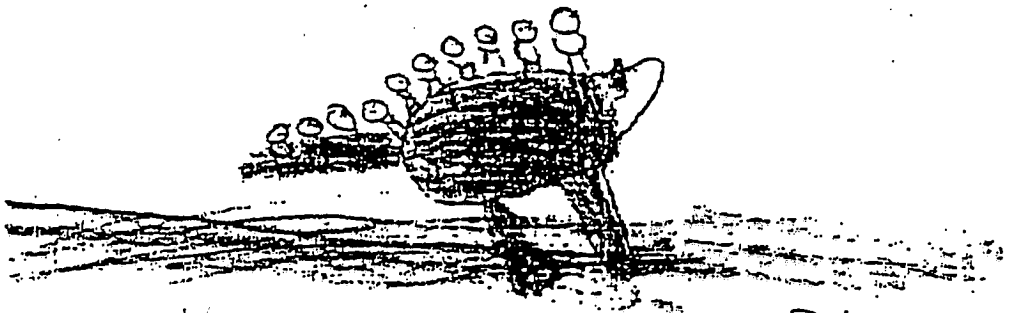
a.Yes
b.No

Soon I was dizzy from all the questions!

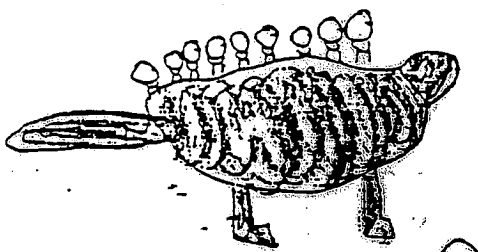
If there is 21 students in my class and then 5 went home how many students are in my class?

a.14
b.16
c.18

Creative Writing



10 LiTTle PeoPle
SiTTiNg ON a
KoDiaK Bear ONe
fell OFF aND BuMeD
HiS Heal.



9 LiTTle PeoPle
SiTTaN a
KoDyAiK Bear.
ONe Fell OFF
aND BuMPeD HiS
HeaD.

seeds. There's 18 cups with 20 seeds in them. How many seeds are there in the pumkin?

$$\begin{array}{r} 18 \\ \times\ 20 \\ \hline 370 \end{array}$$

Pumkin #2 has 514 seeds and Pumkin #4 has 370 how many more seed does pum #2 have then #4.

$$\begin{array}{r} 514 \\ -\ 370 \\ \hline \end{array}$$

1591
2513
3986
4370
5532
6410

1. Pumpkin #1 has 591 seeds. If 4 pumpkins have the exact same number of seeds. How many seeds do you have in all? Show your work. 2364 seeds in all

$$\begin{array}{r} {\scriptstyle 3} \\ 591 \text{ seeds in pump. \#1} \\ \times \quad 4 \text{ \# of pump.} \\ \hline 2{,}364 \text{ seeds in all} \end{array}$$

2. Pumpkin #2 has 513 seeds. Pumpkin number 3 didn't get counted in time & they got mixed. The total seeds was 999. How many seeds were in pumpkin #3? Show your work. 486 seeds

$$\begin{array}{r} 999 \text{ seeds in all} \\ -513 \text{ seeds in pump. \#2} \\ \hline 486 \text{ seeds in pump. \#3} \end{array}$$

Pumpkin #
1. 591
2. 513
3. 486
4. 350
5. 532
6. 410

Don't Show!

Story Problem (1)

Pumpkin #4 has 340 seeds.
Pumpkin #1 has 591 seeds.
If you add them together do they equal 900. True or (False)?
Show your thinking

They equal 961
so that means false.

$$\begin{array}{r} 340 \\ +591 \\ \hline 961 \end{array}$$

Pumpkin #1 - 591
2 - 513
3 - 486
4 - 340
5 - 532
6 - 410

Story Problem (2)

Pumpkin #3 has 486 seeds.
Pumpkin #6 has 410 seeds.
True or (False) it equals 991 seeds?
Show your thinking

76

$$\begin{array}{r} 486 \\ -410 \\ \hline 076 \end{array}$$ (076)

Friday's here again!

This past week your child did not do much work in his/her journal. Instead we were working on a class chart of the multiplication tables. Because there isn't much work to review I am not sending home the journals. Instead, please sign and return this note.

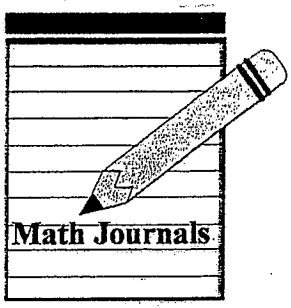
The students worked in groups of four on two different numbers. They were responsible for cutting out the grid boxes, gluing them in the appropriate columns and labeling them.

The second part of this project is making a book of the multiples your child is still unfamiliar with. Thee books will go home the first part of next week and can be a resource for your child.

We also took time this week to go over some math homework problems that were missed by many of the students. We reviewed the fact that you cannot add or subtract hours and minutes the same way you do regular math problems. We looked at several strategies for solving time problems.

Finally, we brainstormed strategies for figuring out multiples. I will send this list home next week. After tomorrow, we will no longer be spending class time on strategies for the multiplication tables other than continuing the timed tests. It is now up to your child to master them on his/her own. Speaking of which, 4 students have successfully completed their facts through 12. CONGRATULATIONS!!

Mrs. E

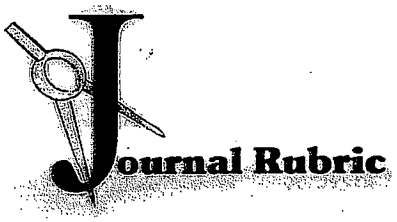


Math journals form an integral part of your child's math curriculum. What is a math journal? It is a collection of all your child's work through out the year. Included in the journal are Daily Tune-Ups (review and reinforcement of basic skills), activities that correspond with the math units, games, explanations, and reflections. In other words it will become your child's "textbook/resource". It will also be a portfolio of your child's progress in mathematics.

As the year progresses you should see growth and changes in your child's work. Your child's understanding and explanations should improve, the work should become more detailed, and new concepts should be added.

Your child will be expected to bring the journal to class everyday. There should be daily entries that are dated, the work should be in pencil, and the table of contents should be kept up to date.

The journal will represent one-half of your child's grade in math each quarter. It will be checked approximately every two weeks using the rubric (see below) that the students developed. Each time it is checked I will ask your child to bring the journal home for your signature and comments. Please take time to look through the pages and ask questions. If you have questions or comments feel free to contact me.



Appearance:

4 3 2 1 Name, date, neat and legible, no tears or stains, used pencil,
Format:

4 3 2 1 Organized: table of contents, titles of activities, pages numbered,
Accuracy:

4 3 2 1 Uses proofreading, work is accurate, follows directions
Explanations:

4 3 2 1 Clear, concise, understandable

Ms. Eisinger

Dear Parents,

Thank you so much for your responses to my questionnaire. As a result I will begin sending the journals home every Friday, or the last school day of the week. I will be asking you to sign them and the students will be held accountable.

I will not however, grade them each time. My goal is to grade them three times a quarter. Any more than this and I won't have a life outside of school!

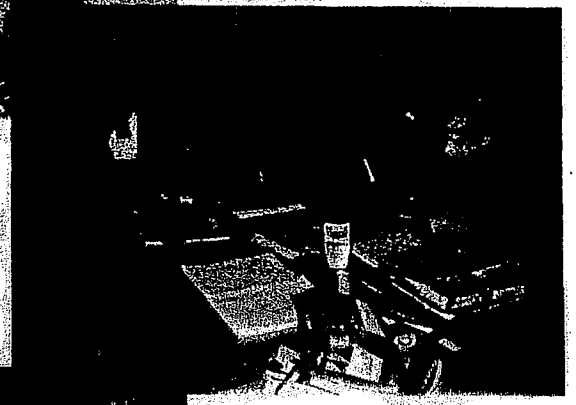
When the journals come home I am going to try something new. I will include some questions you might want to ask, and a brief summary of what we did during the week. This might help you to get a better picture of how your child is doing. You do not have to use this and it does not have to be returned. However, I would welcome any comments about using it and whether I should continue to send them.

Mrs. Eisinger

Ms. Thompson's class discussing mathematics

Ms. Eisinger's class counting money from R Feather.

Ms. Hirata's class working in their journals.



Ms. Theda's class working on circle graph

Optional

Key Mathematical Ideas

Chapter summaries

Weekly notes to parents

Expository writing
&
Journals

192 hours without T.V.

Kyle Moore 4/25/93

If one person went without T.V. for 8days it would be 192 hours without T.V. The more people that join the 8days without T.V. the more hours it will add up to. This 8day study was attempted by Cumming's fourth grade students from April 15th to the 22nd.

Ms. Esinger's class of 20 students watched 155 hours of T.V. for an 8 hour per student average. Other classes had averages as high as 16 hours. On Friday and Saturday Ms. Hirata's class watched 198 hours. Ms. Theda's class total was twice as much as Ms. Esinger's class. On the weekend fourth graders watched 330 hours total. At 155 Ms. Esinger's class watched the least hours of T.V. total. I think we should do this project again because it gets kids outside instead of inside watching T.V. Plus I don't really watch a whole lot of T.V. anyway .When kids get bored they turn on the T.V. but they should go outside and run around or play with a friend.

Very well written! ☺

Kristen C.

I think that math is the pursute of laziness. means that math is lazy and boring and not intresting, but if you look at it my way you will be real intressed and know that you use math all through your life.

I am glad I learned to do math because math has alot of interesting facts you can learn like fractions. fractions are cool but sometimes they get hard to figure out. I learned how to make the dinominators the same by adding subracting, multipling or dividing. I learned that there is more than one way to multiply to get your answer. I only got used to two ways witch are the dimond method and multipling the ones on the smaller number by all the numbers, then go to the tens and do the same thing. There is alot more that I've learned but if I wrote it all down it would take up the front and the back of the page I'm writing on.

For third graders that are going to be fourth graders next year and go to a math class I am going to tell you about math class. The math class is very interesting.

Susan Stahlman

① "Math is a pursuit of laziness" means that math is actually an easier way of doing all calculations and stuff instead of counting things you can use math and save lot of time.

② I've learned alot of things this year about math. I've learned the meaning of "Math is a pursuit of laziness". I've gotten better at my math tables. I've learned alot about equivalent fractions.

No TV Strikes Cummings

From April 15-22 Cummings Elementary had Turn Off TV Week. The Fourth Grade did a survey on how many hours they watched TV during that eight days. The average number of hours students in the entire fourth grade watched TV is 12 hours per week.

The difference between the class who watched the most TV (Ms. Theda's class) and the class who watched the least (Mrs. Eisinger's class) is 138 hours. My class, which is Ms. Hirata's, watched 312 hours. The difference between my class and the class who watched the most is 26 hours. On Saturday all of the classes watched a total of 203 hours!

Out of all of the eight days I watched a total of 6 hours and 45 minutes. My average time per day is 51 minutes. I tried to watch less TV than I normally do, and I did! I think that we should do Turn Off TV Week again because it gets kids to realize that TV isn't the only thing to do in their lives.

By: Kristen Ruby

well written ☺

① Math is the pursuit of lasiness.
This means that math helps you
find out numbers quicker.

(2) This year I learned a lot of things. I learned how to multiply double digit numbers. I learned to divide numbers like 36 divided by 6, it is also the oppisite way of multipling. I learned how to add and subtract Fraction. I also learned geometry, what a venn diagram is, and thats about it.

This is what I learned this year.

This may include:

- Describing
- Recording
- Writing instructions
- Rewrite a story problem

"Writing is an important and valuable tool that can support students' learning."

Marilyn Burns

Treat people as if they were what they ought to be, and you help them to become what they are capable of being.

Johann Von Goethe

Name

1 Which Sum Is Greater?

84 + 26 = 110

98 + 16 = 114 ✓

Explain your thinking.

I know that answer is write because, I added the eqetions and found out witch one was greater.

84 + 26 = 110

98 + 16 = 114 (4)

2 Choose the Correct Answers

Which problems have a product greater than 100?

A 5 × 15 = 75

B 6 × 20 = 120 ✓

C 7 × 16 = 112 ✓

D 3 × 30 = 90

Explain how you know.

I did all the eqetions and found out the answers. ON BACK

3 How Much Money?

Yang paid $72 for 8 T-shirts. Each shirt was the same price. How much money did each shirt cost?

Show your thinking.

9.00 for each T-shirt

8 × 4 = 32

8 × 2 = 16

32 + 16 = 48

8 × 3 = 24

48 + 24 = 72

4 True or False?

True

20 × 30 = 600

Prove it.

20 × 30 = 600

Name .

1 Which Sum Is Greater?

84 + 26 = 110

98 + 16 = 114

Explain your thinking.

84 + 26 = 110

98 + 16 = 114

I added them both and got 98+16= 114 which is greater than 110.

Great!

2 Choose the Correct Answers

Which problems have a product greater than 100?

A $5 \times 15 = 75$

B $6 \times 20 = 120$

C $7 \times 16 = 112$

D $3 \times 30 = 90$

Explain how you know.

I multiplied all of the above and got B and C for my answers. greater than 100.

3 How Much Money?

Yang paid $72 for 8 T-shirts. Each shirt was the same price. How much money did each shirt cost?

$9 per T-shirt

Show your thinking.

09 per T-shirt

T-shirts 8 | $72

-72

00

4 True or False?

20 × 30 = 600

True

Prove it.

30 × 20 = 000 + 600 = 600

2

24 × 5 = 120

Name ___

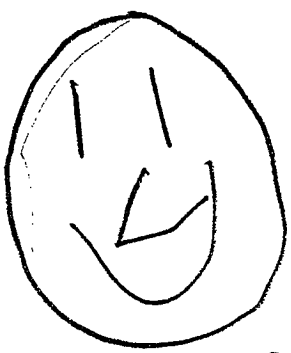
Agree or Disagree?

his is how Nakesh solved the problem:

ler has 8 quarters, 20 dimes, and 15 nickels. True or false?
ler has $4.50. Explain your thinking.
o you agree or disagree with his answer?

FALSE

It cannot be $4.50 because if there is an even number of quarters and dimes + 75¢ (an odd number) it can't be $4.50 because it is even!

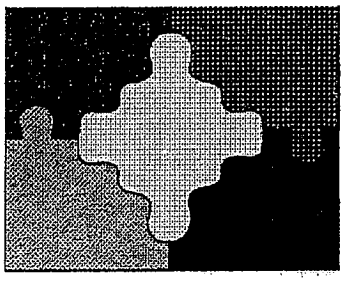


Nakish

AGree

Because he is right.

no work see me



Quilt Project

Over the past two months we have worked on designing and them making one quilt for each classroom. This has been a cooperative project between students and between students and parents. **This project is due June 1**

The following items must be included:

____ A picture of your group block. It should be as close to the actual block as possible in terms of colors. Don't worry as much about the designs.

____ The length, width, area and perimeter of your block either with or without the border (please specify)

____ The length, width, area and perimeter of your class quilt

____ Three things you learned about the quilting process (look at your notes)

____ At least three ways you used math for this project (check your class notes)

____ Your opinion of the project to include what I might want to change next year, why you thought it was a good or not so good project, and what you thought the best part was.

____ Spelling, grammar, and neatness will be ¼ of the grade. Please no half pieces of paper or paper torn out of notebooks.

____ You might put your picture on the top and your report on the bottom, if you are using the computer you might want to try drawing the design on the computer. If you want a lesson I will offer one during lunchtime this week and next week.

What you turn in you should be proud of and want displayed in the hall.

Newspaper Account

We have just finished a week of reduced or no TV. You have collected data on yourself or your group as well as information on your class.

You are going to use this information to write a newspaper article. Your article should included the following:

____ A Headline (something that will attract interest)

____ Who was included in this sample: Cummings's Fourth Grade Students

____ The dates of this event: April 15-22

____ The average number of hours students in your class (or the entire fourth grade) watched TV. Total number of hours divided by total number of students.

____ Four statements that compare the results of your class with at least one other class. Be sure to identify which classes you are using.

____ My personal contribution: How many hours did **you** watch TV? Did you watch it less than normal, the usual, or more than usual

____ Should we do this again? Why or why not?

Name

1 Which Sum Is Greater?

① 84 + 26 = 110

② 98 + 16 = 114

Explain your thinking.

I added each equation and ① 110 and ② 114. 114 is greater.

4

2 Choose the Correct Answers

Which problems have a product greater than 100?

A 5 × 15 = 75

B 6 × 20 = 120

C 7 × 16 = 112

D 3 × 30 = 90

Explain how you know.

I did each equation and the product of B and C were greater than 100.

3 How Much Money?

Yang paid $72 for 8 T-shirts. Each shirt was the same price. How much money did each shirt cost?

Show your thinking.

9 for each t-shirt cost
T-shirt $72 is cost
-72
00

4 True or ~~False?~~

20 × 30 = 600

Prove it.

TRUE

20 multiplied by 30 equals 600.

Snow and Water

Written report: Due Monday, January 12th.

In your report include the following:

1. Definition of snow (use your dictionary)
2. Amount of the snow sample you collected
3. Hypothesis: incudes: Estimated time for melting, estimated amount of water after melting, you ideas on what would happen to the snow and how much water would be left
4. Conclusion: includes the actual amount of water, the time it took to melt, and your ideas on the results.
5. Compare the amount of snow with the amount of water. What is the difference? Do you think you would get the same results if you did this experiment again?

The report needs to be in paragraph form, one paragraph for the hypothesis and one for the conclusions, and one paragraph for number 5.

I will be looking for:

Content: the information
Spelling
Grammar
Legibility

Reminder: When writing about measurements be sure to include what you are using i.e ml (milliliter), cc (cubic centimeter)

Social Studies Project
Fourth Grade

Student Name: _____
Region: _____

Excellent (6)	**Pretty Good (5)**	**Not So Good Yet (4)**
Outline with lots of details done in correct form	Outline done in correct form; not many details	Incorrect form or no details
Various **Landforms** named and described	Some **Landforms** named; not well described	Some **Landforms** names, not described
Occupations listed and explained in detail	**Occupations listed and somewhat described**	**Occupations** listed
Natural resources and how people use them are well explained	**Natural resources** and how people use them are mentioned	**Natural Resources** mentioned
Two important cities of the region listed…and **why** they are important cities well explained	Two important cities of the region listed…and why they are important cities is mentioned	**Two** important cities of the region are listed
Places of interest mentioned, what you could do there explained, and **where** these places are discussed	Places of interest are mentioned, what you'd do there is mentioned	Places of interest mentioned
Work done neatly	Work done adequately	Work done sloppily
No spelling, or grammar mistakes	Some spelling and grammar mistakes	Many spelling and grammar errors
____x 6 = ☐ points	**____x 5 = ☐ points**	**____x 4 = ☐ points**
BONUS: 4 Bonus points if you include a list of the states and capitals of your region!		**Total** Points x 2 = ____ + Bonus = ____%

Criteria for Credit*

When work meets the Criteria for Credit, then it is eligible for grading and credit.

The work is....

- neat
- organized down (not across)
- free of "cross-outs"
- stapled, labeled, and arranged properly
- done in a timely way, and
- signed as evidence of "best effort"

With...

- directions followed
- important steps shown
- answers indicated and well labeled

For qualifier status...

- errors are corrected
- the assignment is complete, and
- it is signed as evidence of "zero defects"

*Developed and used in secondary mathematics

Rubric for *A Note to a Friend* (Specific Content and Anchors Need to be Provided)

	Content Accuracy	Description Thoroughness & Clarity	Example Complexity	Visual Display	Mechanics
Exemplary 5 points	The content is free of any math errors.	Description is logical, accurate, well organized, & very thorough - easy to understand.	The complexity & depth of the examples exceeds the standards established for the assignment.	It is very easily read & interpreted due to lay out, neatness and use of color and shading. Graphics are accurate.	Criteria for credit met.
Competent 4 points	The content contains only one or two inconsequential errors - all essential skills and concepts are apparent.	Description is mostly logical, accurate, organized - it is complete but not thorough - understandable to a pro.	The complexity & depth of the examples meets the standards established for the assignment.	It is interpretable due to lay out, neatness and use of color and shading. Graphics are mostly accurate (only inconsequential errors.)	
Developing Incomplete	A major math conceptual error is present, but much is correct and shows "essential" understanding.	Description is incomplete, illogical, inaccurate, and/or unorganized enough to show limited understanding - clarified with discussion.	The complexity & depth of the examples meets the most common and essential standards established for the assignment.	It is difficult but possible to interpret. Graphics are mostly accurate (only inconsequential errors.)	
Emerging Incomplete	Major math conceptual errors exist. Awareness only is apparent.	Description is very flawed and not truly follow-able.	Standards not met.	Nearly impossible to locate and interpret essential concepts.	Criteria for credit not met.
Not Score-able	No attempt or totally incomprehensible				
Note: Criteria are evaluated separately – one "incomplete" results in an incomplete for the task.					

This rubric was developed by Jim Ludington and Spence Rogers for use in Jim's classroom at Gananda High School.

Writing Rubric
Student developed "Coaching" rubric

Criteria	Done Well	Not Yet
➢ One paragraph for every main idea	☐	☐
➢ Explanations or examples for your opinions	☐	☐
➢ Neat penmanship	☐	☐
➢ Words are spelled correctly	☐	☐
➢ Sentences all punctuated correctly	☐	☐
➢ Paper headed correctly	☐	☐

Fourth Grade class Okinawa

Rubrics

Rubric came from Latin meaning rubrica which means red chalk. 900 years ago red ink used for printing important directions in prayer books. Used to denote the Word of God in many bibles. Came to mean criteria used to either evaluate the level of quality in an endeavor or to provide guidance to people seeking to reach high quality

Slide

Use rubrics everyday: recommend a restaurant, movie, vacation spot, etc

Slide directions

Write down your criteria for the perfect pair of shoes.

This is a one level rubric; however, if you were working for a major dept store you would need numerous quality levels

Slide

Another concern with a one level is that others may not agree with you. For this reason the precise focus for a rubric must be clearly identified. X says the perfect pair of shoes is

Rubric should have a broader base. You want to utilize more than one person's judgement. In groups define the perfect pair of shoes

A good rubric has exemplars. Here are a pair of what I consider perfect shoes. (discuss characteristics, see if group can come up with a consensus)

As we go on to develop the rubric for a perfect pair of shoes different levels will be developed. What differentiates great, good, acceptable, and poor. Each level will have clear, written descriptions as well as samples. These samples are called anchors.

Two kinds of rubrics: Holistic, measure overall effect with a set of appropriate guidelines; Analytic Rubric: consists of score points assigned to various elements to be looked for, quantitative Make samples

In addition to scoring rubrics, another valuable use is guiding/coaching students to a desired levels of performance

The number of quality levels that need to be defined in a rubric is dependent on focus, intended purpose, developer's ability to clearly and precisely determine the nuances that differentiate the possible quality levels; the specific context for its use

The statements of the various levels of a rubric need to differentiate from one another in discernible ways:

The ability to observe and describe qualitative as opposed to only quantitative characteristics is developmental

Limited to the number is that is most beneficial to the evaluators
Limited to the number in which the developer can truly describe both the qualitative and the quantitative nuances
An even number; to force careful and more accurate differentiation between levels; odd numbers tend to gravitate to the middle rather than distinguishing between levels
Adequate for both the evaluators and the performers to be able to accurately identify the level of performance and what needs to reach a higher level

Clearly define up front the intended use for the rubric: guide/coach/evaluate; the target, and a statement of what the highest quality expectation is; obtain and provide solid examples, anchors for each quality level

Involves students in developing rubrics or involving them in instructional activities that create a conceptual understanding of the levels within the rubric

Kinds:

Analytic: address the component parts or characteristics of a product. One criteria statement for each essential component; tend to be given in list form

Holistic address the product as a whole; includes the essential criteria for a product but tends to be written in paragraph form; overall judgement

Primary Trait: focus on a particular trait

Performance checklists a list of items to be checked off as they are completed or observed

An 8 step process:

1. Determine precisely the product, process, or performance: Perfect Shoes for walking, dress, etc.

2. Determine the intended audience/users for/of the rubric and whether it will be used primarily for coaching or scoring: Audience: Buyers, scoring (purchasing)

3. Determine the intended purpose, impact, effect, and/or result that is to be expected to be apparent as a result of the product, performance, or process: Shoes that people will buy and be satisfied with

4. Obtain three exemplars (models of the highest expected quality) and several examples of unacceptable characteristics (tennis shoe, no support, thong, flat)

Rubrics... An Eight Step Process

- Determine precisely the product, process, or performance.
- Determine the intended audience/users for/ of the rubric and whether it will be used primarily for coaching or scoring.
- Determine the intended purpose, impact, effect, and/or result that is to be expected to be apparent as a result of the product, performance, process.
- Obtain three exemplars (models of the highest expected quality) and several examples of unacceptable characteristics.
- Determine what the product, performance, or process should look, sound, or feel like when it is really good by determining the three to five major characteristics (criteria) that the exemplars have in common. Include anchors, for all levels, to support the rubric.
- Develop the unacceptable quality description for each criteria.
- Develop and label appropriately any desired intermediate quality levels for each criteria. Make modifications throughout the levels as clarity develops.
- Determine common errors to avoid and other characteristics that would render the rubric target not score-able.

Common Rubric Errors

- Vague terms *without clarifying examples* (Examples: Adjectives like nice, good, many, more)
- Negatively stated criteria
- Not observable criteria (Examples: appreciate, value, believe, enjoy)
- Criteria that are not relevant
- Missing performance components
- Too many and/or insignificant components addressed by the rubric (Example: Your paper must have between 300 and 500 words be word processed; be double spaced; provide three or more relevant examples; be free of spelling errors, etc. More than five standards for any particular effort, or major phase of one, diminish the value of each. You could put these on a list of basic requirements or coaching rubric,)
- Lack of supporting examples or models
- Criteria NOT based on actual examples (When we develop a rubric without basing it on actual examples we are studying or have observed, we tend to exclude essential criteria or develop criteria that are not appropriate)
- Not matched to the developmental level of students
- Not co-developed by students (A teacher developing a rubric by him/herself for a classroom project and then giving it to the students expecting high levels of commitment and understanding. People tend to hit the targets they set for themselves because they are more committed to them and understand them better.)
- More quality levels than can be supported by the intended use (In early developmental tages in rubric development we tend to focus more on numerical criteria distinctions as opposed to qualitative distinctions which are often more accurate or appropriate; Is the number of supporting statements more important than how convincing the supporting statements are

Rubric Vocabulary

Rubric
The essential quality criteria by which something is evaluated or developed.

Criteria
Those components (or attributes) of a product, performance, or process that are essential for a high quality result and the expected standards of performance for each.

Coaching Rubrics


Rubrics used to coach students until their work is exemplary or until it meets the criteria required for scoring (criteria for credit).

Scoring Rubrics
4
3
2
1
NS

Rubrics used for scoring (evaluating) student work.

Student Developed Rubrics
Rubrics, either scoring or coaching, developed by students through their analysis of examples.

Exemplars A+
Examples (anchors for) of superior "work."

Anchors
Examples of "work" that provide essential clarification of criteria.

Quality Levels
The defined levels of QUALITY that are identified for the criteria in a scoring rubric.

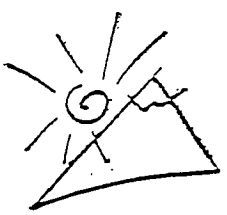
World Class	
Exemplary	4
Proficient	3
Developing	2
Emerging	1
Not Yet	N.S.
Not Score-able	

Holistic Scoring
Assigning a single score to "work" based on an overall impression – most appropriate at system levels.

Analytic Scoring
Assigning separate scores for each criteria – most appropriate for classrooms.

Rubrics For . . .

Products Such As Books. Essays, Posters, & Models	Performances Such As Oral Presentations, Acting, and Recitals	Processes Such As Debating
The criteria address quality characteristics of the product and its effectiveness.	The criteria address quality characteristics of the predictable, performance actions, applicable supporting materials, and the student's effectiveness in the performance.	The criteria address quality characteristics of the predictable and unpredictable actions (necessitated by the process) and the effectiveness of the use of the process.



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Rubric-Based Assessment: What, How, When, and Why

The 3 R's of Assessment

The "3 R's" of assessment are Rubrics, 'Riting, and 'Rithmetic. Both the products of the writing process along with the rubrics used to grade these products and samples of the new open-ended math along with the rubrics used to grade them are important parts of the new assessment and ready-made components of portfolio assessment. This is true whether you are thinking of the portfolio as a containe or as a method. The written pieces and the math samples not only go into the portfolio but also lend themselves to the process of reflection which is one of the unique features of portfolio assessment.

What Is an Open-Ended Math Problem?

An open-ended math problem is a problem constructed in such a way that the student is encouraged to be creative in working toward a solution. The problem may have more than one potential solution and its purpose is to help the student clarify the thinking inherent in a math concept rather than reach some "right" answer. It may also involve a spin-off into other concepts or multiple applications of the origin concept. The use of a rubric to grade open-ended math problems helps to keep the focus on how the student thought about the problem rather than what the answer turned out to be.

What Is a Rubric Anyway?

The word "rubric" literally means "rule." When the word is used in connection with assessment, a rubric is a scoring guide that differentiates, on an articulated scale, among a group of student samples that respond to the same prompt and range from the excellent response to one that is inappropriate and needs revision.

How Many Kinds of Rubrics Are There?

There are two types of rubrics: *holistic* and *analytic*.

A Holistic Rubric

- This rubric is used to measure the overall effect of a piece of writing (or any response to a prompt) with a set of appropriate guidelines. A holistic rubric is not quantitative.

An Analytic Rubric

- This rubric consists of score points assigned to various elements to be looked for in a written response. Analytic rubrics are totally quantitative.

Tom and Sue saw some chickens and pigs in a barnyard. Tom said, "There are 18 chickens and pigs." Sue said, "yes, and altogether they have 52 legs." How many chickens and how many pigs did they see? Provide a written explanation of how you arrived at your answer.

Coaching Rubric for Written Responses to Mathematics Problems		Done Well	Not Yet
roblem Statement	Write a concise statement of the problem. Write clearly enough so that someone picking up your paper could understand exactly what you were asked to do.	☐	☐
lan	Tell what you did to solve the problem. Include what you are asked to find, what you know, and what you need to know.	☐	☐
Vork	Explain in detail what you did to solve the problem. Use charts and graphs where appropriate. Tell what worked, what didn't work, and what you did when you got stuck. What kind of help did you get from someone else.	☐	☐
nswer	State your answer to the problem. Tell why your answer makes sense.	☐	☐

5. Determine what the product, performance, or process should look , sound, or feel like when it is really good by determining the three to five major characteristics (criteria) that the exemplars have in common. Include anchors to support the rubric

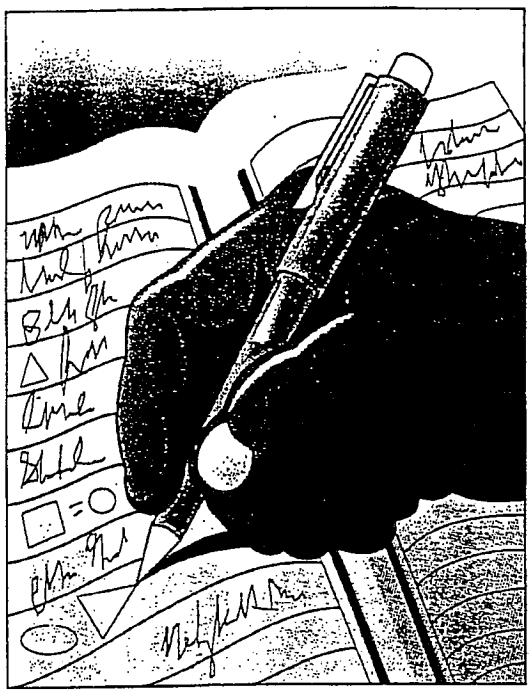
6. Develop the unacceptable quality description for each criteria

7. Develop and label appropriately any desired intermediate quality levels for each criteria. Make modifications throughout the levels as clarity develops

8. Determine common errors to avoid and other characteristics that would render the rubric target not score-able.

Patricia Pokay and Carla Tayeh

PRESERVICE ELEMENTARY TEACHERS: BUILDING PORTFOLIOS AROUND STUDENTS' WRITINGS



Traditionally, college mathematics courses have rarely asked students to write or to reflect on their learning, concentrating instead on textbook exercises and problem sets in a lecture format. The intent of this study was to model the use of portfolio assessment in a college mathematics course for preservice teachers while focusing on the contributions of the students' writing in the mathematics classroom. In the study, portfolios were the vehicle for organizing the students' writings.

The release of the NCTM's *Curriculum and Evaluation Standards for School Mathematics* (1989) spurred a reform movement that calls for instructional practices to shift from "teaching by telling," memorizing rules, and relying on follow-the-example exercises to emphasizing open-ended problems, written and oral communication, active engagement, and mathematical connections. Evaluation is redefined as an integral part of teaching and of improving instruction. The inability of past assessment measures to reflect students' understanding of mathematical concepts and procedures has led to a push toward alternative assessments in mathematics, including open-ended questions, projects, self-evaluation and peer evaluation, performance assessment, observation, interviews, and portfolios (Clarke, Clarke, and Lovitt 1990; NCTM 1989; Stenmark 1989). Implementing the *Curriculum and Evaluation Standards* will require that teachers be receptive to these alternative approaches to teaching and to assessing students' learning. The reform movement focuses on learning and teaching K–12 mathematics, and the education of preservice teachers affords an ideal place for intervention. If future teachers are to implement these recommendations in K–12 classrooms, they first need to see these practices modeled during their training.

A growing body of evidence suggests that writing in the mathematics classroom facilitates learning and serves to improve communication between student and teacher (Azzolino 1990; Geeslin 1977; Johnson 1983; McIntosh 1991; Mett 1987; Miller 1991; Nahrgang and Petersen 1986). Writing is a unique tool in mathematics classrooms because it allows students to record, reflect on, and modify their ideas about mathematics. In this way, it helps to clarify relationships and make connections among concepts (Emig 1977; Rose 1989, 1991). This type of reflection and modification is important in developing thinking and reasoning skills, skills the *Curriculum and Evaluation Standards* has articulated

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FIGURE 1

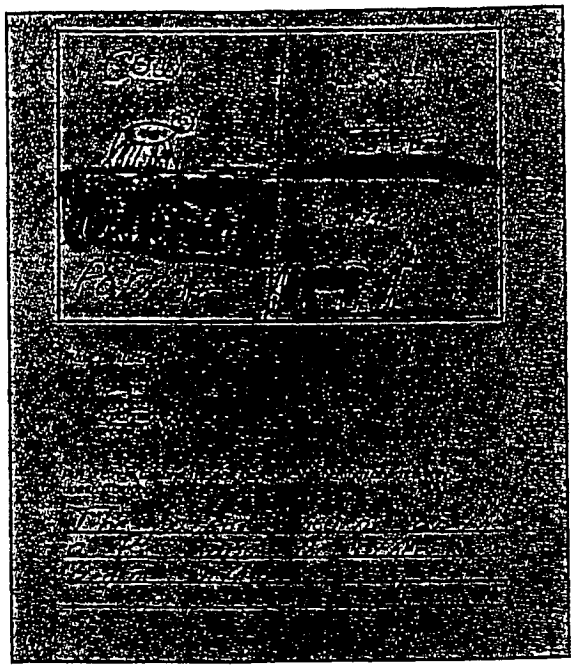


FIGURE 2

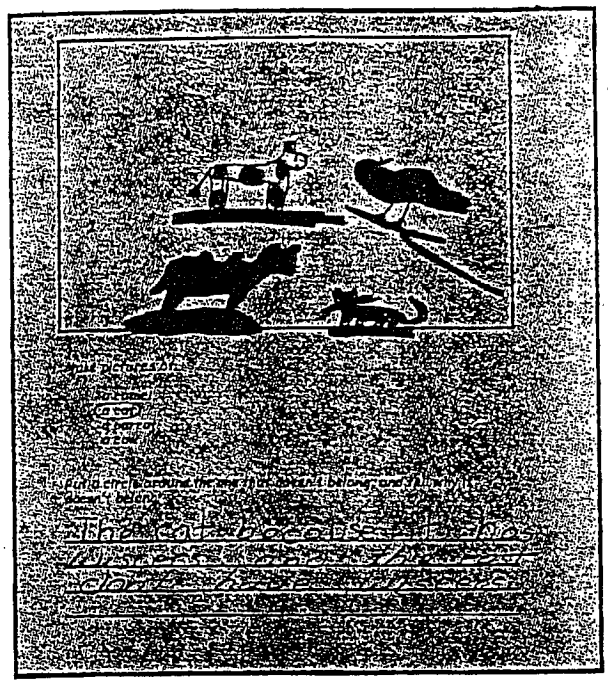
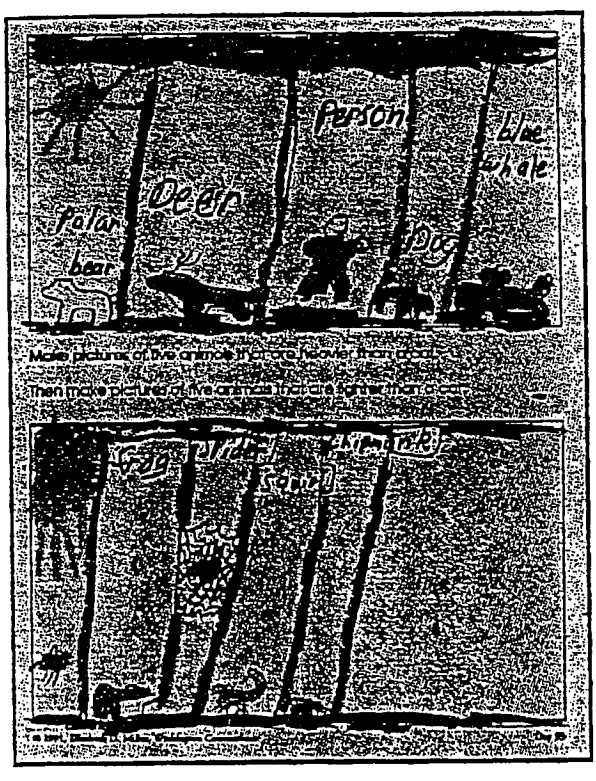


FIGURE 3

FIGURE 4



Reasoning and justifying solutions are part of their everyday lessons, and students are not intimidated when they encounter new concepts. I have seen this attitude spill over into all areas of the curriculum.

At the time this article was written, these materials were not commercially available. They are the sole work of the author. For additional information on this program and a sample of the materials, send a self-addressed stamped envelope to Elizabeth Miller, 49 South Street, Washington, CT 06793. ▲

as being important in mathematics. An argument can be made that writing is even more important in mathematics classroom for preservice elementary teachers (Burton 1985; White and Dunn 1989). Ideally, these students should learn the mathematics content while reflecting on themselves as learners of mathematics and as classroom teachers.

This goal of encouraging preservice elementary teachers to reflect on the mathematics and on the learning process prompted the initial use of portfolios built around students' writings. Portfolios help students develop the ability to assess their own work as well as help them visualize the learning that has taken place during the semester (Wolf 1989). Most studies on student portfolios have, however, focused on elementary and secondary classrooms or have been found in college courses in the arts and humanities. The focus of this study was on using portfolios with preservice elementary teachers to encourage them to reflect on themselves as learners of mathematics and to begin to reassess their role as a classroom teacher.

The purpose of this article is to share what was learned about using portfolios and writing with preservice teachers. Specifically, the procedure that was used and information about what was learned from student self-evaluations about the students and teaching will be presented.

Project Background

To explore the use of mathematics portfolios with preservice elementary teachers, a geometry class was chosen that is required of all elementary education students majoring or minoring in mathematics and that is usually taken during the sophomore or junior year. Thirty-six students, thirty-two females and four males, enrolled in the course, which focused on topics in informal geometry. Instruction emphasized group work. Students were to develop their own theories and discover connections among geometric concepts and express these connections in writing. For example, students were given a word bank—*transformation, isometry, rotation, reflection, translation, congruent,* and *similar*—and were told to write a paragraph that showed how these concepts were related. The instructor overtly focused on *(a)* mathematics as a process, such as the ability to invent procedures and make generalizations and the ability to reason and problem solve, and *(b)* the importance of motivational factors, such as self-confidence and perseverance. Class procedures included problem-solving activities, active involvement in learning mathematics concepts, open-ended problems, and cooperative groups.

Out-of-class activities involved reflection papers and journal entries in addition to the more traditional homework assignments. Reflection papers consisted of weekly essays in which the students wrote about what they learned and how they felt about the material for that week. Some students summarized key ideas, and other students discussed pertinent questions that they had with respect to the material. Journal entries were also written on a weekly basis. These entries were different from the open-ended, free-writing nature of the reflection papers because they included responses to specific prompts. The prompts were often related to mathematics content—for example, Explain why five and only five Platonic solids exist—and to student attitudes—for example, What have you accomplished in this class over the last two weeks that has made you most proud of yourself?

Each portfolio comprised two parts. The first part, usually referred to as a *working portfolio,* consisted of a collection of student work that included reflection papers, journal entries, homework, and tests. At the end of the course, students were asked to use their working portfolio to develop an evaluation portfolio by analyzing their learning throughout the semester. In the evaluation portfolio, students were asked to select items that gave proof or evidence of (1) their problem-solving ability, (2) their confidence in their mathematics ability, (3) their determination to stick with a problem, (4) their most valuable experience in the class, and (5) an activity in which writing helped them to learn. For each item selected, students wrote letters explaining why they made that selection.

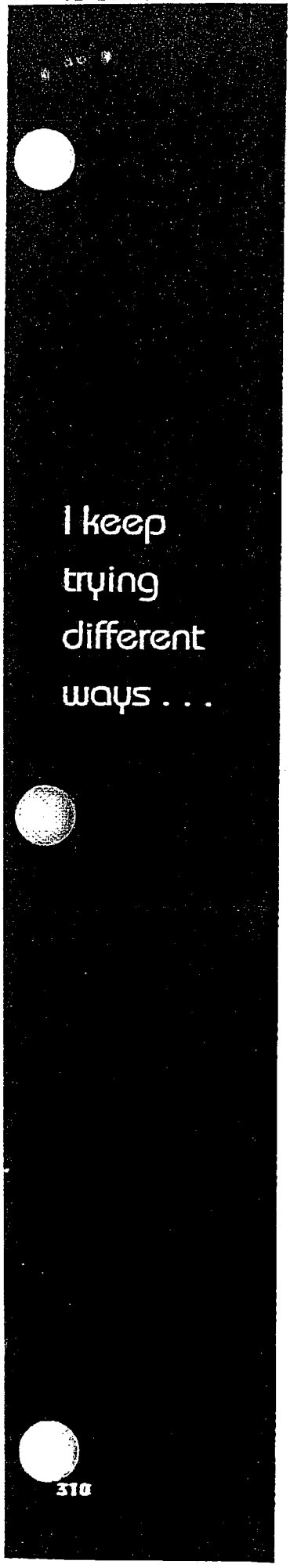
When students turned in their evaluation portfolios at the end of the semester, the instructors read through the students' writing looking for themes and noting general impressions. Students obviously had learned a lot from this procedure. In addition, their work revealed insights about teaching methods and students that would not have been gained through more traditional methods of evaluation.

Learning about Students

As students' responses were read, the instructors were struck by the realization that much of what students chose to write about would have remained unsaid had they not been asked to write. These topics included (1) feelings concerning mathematics, (2) reflections on processes used to solve problems, (3) activities that took place outside of class, (4) students' expressions about themselves as learners, and (5) students' expectation of themselves as future teachers.

1. *Students' writings expressed their feelings about mathematics.* Although group work and activities in the classroom allow instructors to observe

The journal included responses to specific prompts



students' interaction with the material, recognizing when an experience makes a long-lasting impression on a student is less clear. Students' writings, however, demonstrated clearly how specific topics and activities touched the students in ways not usually observable. For example, following a lesson on tessellations, one student wrote the following:

My brother has a shirt with an Escher drawing on it. When I first saw it, I thought it was a different kind of strange-looking picture. But once I found out what the whole picture was made of, I began to look at it quite differently. It seems strange that you can look at something 100 times and see the same picture, but when you begin to learn more about it, you look at it in an entirely different manner.

Another student similarly expressed her awe of mathematics in this statement:

Patterns have been around for a long time. They are not theories, they are facts. Patterns are some of the few things that have always existed without doubt. How can you not appreciate that?

Not only did writing allow students to express positive emotions concerning mathematics, but it made the teacher aware of students' recognitions. Another type of emotion was also represented in the writings of students:

I chose this problem because I have never been more determined to stick with a problem in my life! I will remember this hideous, horrendous . . . problem forever, because I was determined I would get this tangram puzzle if it killed me. I don't think I've ever been more frustrated!

Such emotions would likely not have been expressed in a class full of students. In each situation, writing allowed the student a chance to express feelings and the teacher a chance to recognize, and possibly respond to, the student in a private way.

2. *Students' writings helped illustrate how students were processing information and solving problems.* Often, students are asked to "show their work" to demonstrate their understanding. In this study, students' explanations of their problem solving allowed the instructors to see more clearly how they were going about doing their work. For example, one student gave the following explanation:

I spent almost the whole entire hour trying to figure out how I was going to solve that problem. (I still got it wrong!) I tried to imagine it folded up, tried to come up with different equations, tried to break it up into separate sections and many other techniques. I do it [problem solve] to the best of my ability or until I exhaust all other possibilities.

Another student wrote the following:

I didn't know an easy formula to solve these problems, so I broke them down into smaller problems I know how to do. I then combined the knowledge and answers I gained and came up with the answers for the larger, original problem.

Thus, not only can students become more aware of their own procedures by explaining them on paper, but the instructors are able to monitor the processes that students use and help them with study skills needed.

3. *Students' writing informed the instructors about activities outside the classroom.* Another aspect of students' learning that became evident through students' writings focused on learning and activities that took place outside the classrooms. Often, students are observed working in class, but their activities in the days between class sessions remain unknown. Students' writings gave a glimpse into the student's life between those class sessions. For example, when asked to explain why she chose to discuss a certain problem, one student responded thus:

I chose this problem because I worked on it for several days. I even went to the mathematics tutor in the library, and she couldn't do it. It took me about two days to find the answer. I learned that the problem was a combination of two problems. I knew that I was patient but to work on the problem for two days and come up with the correct answer was a wonderful feeling.

This example not only showed persistence on the part of the student but also how she felt about her effort. Another student voiced a similar process:

Even though I knew how to do this problem, my answer never came out even. I searched and searched geometry books and other mathematics books to see if I was doing it wrong. I came to find out I had done the problem correctly.

A third student gave this explanation:

I had done all my other studying for the test and was left with figuring out this sphere problem. I read the section about it over and over in the book. I studied my notes over and over, too. I had read it so many times, I had it memorized. I wasn't happy with just memorizing the process, though. I wanted to understand it. I had been in my kitchen working on it. I got frustrated and left the room to do something else. When I came back I studied it again and finally something clicked.

All these examples furnish information about students' learning that would not have been apparent had course activities included only the traditional chapter problems and assignments. These examples demonstrate the persistence that students exhibit but teachers do not usually know about.

4. *Students' writings revealed how students felt about themselves as learners.* As has already been suggested in some of the previous examples, insights were gained into how the students viewed themselves as learners of mathematics. One student wrote this response:

I felt more confident knowing I could derive a formula instead of just using a formula to plug numbers into.