

## Writing Across the Curriculum at the McCallie School

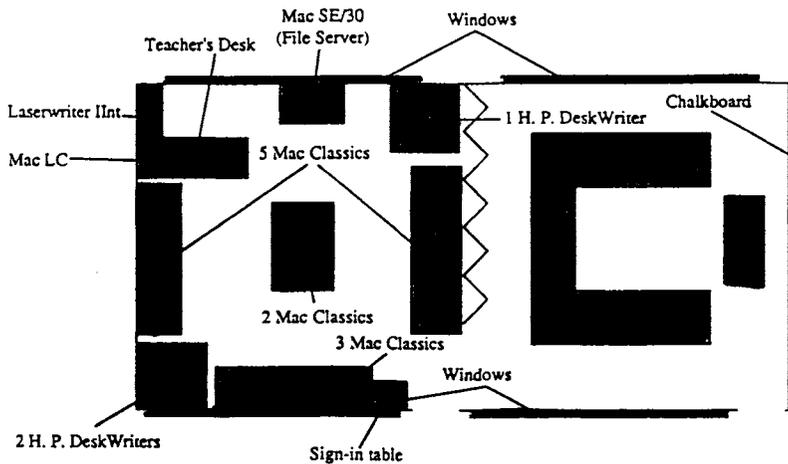
Pamela B. Farrell-Childers with Peter LaRoche, Cissy May, Catherine Neuhardt-Minor, Lance Nickel, and David B. Perkinson

### **A Plan for Change at McCallie (Pamela B. Farrell-Childers)**

An endowed chair of composition dedicated to writing across the curriculum (WAC) at an independent boys' school in Tennessee? It sounds highly unlikely, yet innovative, even logical. A family by the name of Caldwell believed that such a position needed the commitment of money to make it a reality. As Hacker Caldwell said, "I had learned [at the University of Virginia Business School] that the primary value of improved writing was clearer thinking with a secondary value that it improved my critical ability to read." So in 1991 the Caldwell Chair of Composition became a reality at the McCallie School, an independent day/boarding school of over seven hundred boys in Chattanooga, Tennessee.

The first job of the new chair was to design a three-year strategic WAC plan for McCallie. The two most important concepts of the plan were the creation of a writing center and the implementation of a WAC retreat for faculty. In the fall of 1991 the Writing Center officially opened for students and staff. Designed as a place where there is a reverence for writing, the Writing Center has become a hub for the composing of language and a writing resource for students and staff. With fifteen Macintosh Classic computers and three DeskWriter printers available for student use, the double room offers a writing workshop

**Figure 15-1**  
Caldwell Writing Center Floor plan



environment plus a computer area for writing with the word processor (Figure 15-1). Students and staff across the disciplines use the facility for work with specific writing concerns, writing to learn activities, peer editing, collaborative writing projects, class writing workshops, and individual or personal writing projects (college application essays, grant proposals, etc.).

The first WAC weekend retreat with Art Young as facilitator, held at Cohutta Lodge in the mountains of Georgia, included fifteen members of the faculty from all subject areas. With a focus on writing to learn, Art encouraged participants to develop writing activities to use in their classes. (See essay by Cissy May.) This retreat became the beginning of ongoing WAC faculty workshops and collaborative writing projects throughout the school year. Individual training sessions continue, and retreats are planned for future years until all faculty have attended at least one. Through the faculty newsletter, teachers have an opportunity to share WAC activities from classes in all disciplines, and regular articles keep them informed of guest artists and other opportunities to participate in WAC. For example, each December the faculty presents a poetry reading in the school art gallery. Teachers in all subject areas have participated.

As teachers begin to share the writing activities that work for them, the Writing Center will create files of lessons as resources for other teachers. Teachers and students are changing their focus to reflect writing to think, learn, and know; therefore, the curriculum has begun to reflect those changes. For the future, we plan to involve the

entire faculty in writing, create a McCallie Press to publish professional materials and student works, increase the amount of technical equipment, continue emphasizing the role of guest artists across the disciplines, and improve student and faculty writing, thinking, and learning.

What makes the program at McCallie unique, however, is the faculty. They are willing to take risks, learn from each other, and grow as professionals. On any given day, a student may walk into the Writing Center and see teachers in all disciplines working on pieces of writing at the computer, reading and responding to each other's writing, or planning writing activities for their classes. This modeling of the importance of writing is something that cannot be planned; it cannot be staged, and it cannot exist without teachers who believe in the importance of writing across all disciplines. The selections that follow reflect the first-year activities of the program by such faculty members and demonstrate the possibilities for writing in all subject areas.

### **Writing and Learning Chemistry (Cissy May)**

After attending the WAC retreat, I was eager to try some ideas in my classroom. One of the concepts I learned was letting students write about problems they were having in class, then having other students write back with a solution to the problem. Since we had just completed the factor label system of problem solving that always seems to be a difficult concept for most students, I chose this method for several reasons. First, students were more receptive to help from their peers than from their teacher early in the school year. Second, if students could identify and key in on their problem, they had a much easier time solving the problem. Third, students thought they were alone; but through this activity, all realized that everyone was having some difficulty with the concept. I found that most students took the exercise seriously even though it was not graded. Also, it was a wonderful confidence builder. As I read each of the answers, I added other comments that I thought might help the student (Figure 15–2).

At the end of the semester, I tried another writing assignment in which I asked students to evaluate different aspects of the course. I received some very frank and helpful replies about problem areas as well as information about what students liked about the class, demonstrations, lab work, and help sessions. After compiling the information, I gave the students the results so that they could get an overview of what others felt. This activity made the students feel that they had some ownership in the class and increased their awareness of how other students felt on the classroom issues. Accelerated students don't always realize that some of their classmates spend twice as much time on homework as they do. Students who don't like labs need to understand

Figure 15-2  
Writing to Learn Chemistry

Phil  
Hudson

Factor      Labeling

Getting the conversion factors mixed up + when I'm deciding what to find in the problem how do I tell if it is a factor = for example  $\frac{11 \text{ miles}}{1 \text{ gallon}}$ ?

? — x —  $\frac{1 \text{ m}}{10^3 \text{ nm}}$

↑

Do not know what goes here + how do I tell if it is a fraction or not.

Look for words like contains, per, in any word that relates 2 items.

CMay

Phil,

Well, it is very simple on how you can stop getting your conversions mixed up. You must memorize them. However, once that is completed and the memorization is over with there are several other key factors and steps you must take into consideration before calculating the problem. Don't forget to have what it is that you need ~~to find~~ to find as the product of the problem ready so that your labels will cancel out neatly when you begin the problem. Also, this makes it so that you will be less prone to confuse your factor labels. A factor is something that is set equal to each other. In other words  $1 \text{ m} = 10^3 \text{ nm}$ . That is how you decipher what is and is not a conversion factor is by whether or not it is equal to each other.

Chris Sokan

that it is the high point of the class for others. Where it was appropriate, I wrote comments back to the student explaining why some techniques that I use are important. A few examples of questions and answers follow:

**What part of class do you enjoy most?**

“I find the demonstrations are enjoyable, but what it is that I really enjoy is when we do challenging problems in class that involve several different aspects of chemistry. I find that those types of problems are more of a jigsaw puzzle that take time to figure out and challenge the student.” Chris Lokey

**What changes would you make in the daily routine?**

“Overall the classroom routine runs smoothly because we cover most of what is needed and the time passes quickly. Perhaps a few more demonstrations to break the routine could add the spice we need.” Ben Boardman

“I like the way we spend a lot of time just working problems. We do them one by one. You give us a problem, let us try it, then explain, then repeat. This is very effective for me.” William Lavin

I really like the idea of students writing freely in settings that are not threatening to them. Chemistry is not an English class. I don't expect anything more than an honest answer on exercises like this, and I don't get upset when students don't meet my expectations for grammar and punctuation. The situations above allow students to unburden themselves, to feel that they have a right to their opinions, and to have the fulfillment of helping someone else.

## **Writing and Pre-Calculus (Lance Nickel)**

When students walk into my pre-calculus class fresh from a year of advanced algebra, one of the first questions I ask them is, “Why do you write up problems?” Their silence makes it quite obvious that they have never considered the question. Invariably, their answer boils down to “so you can grade it.” Algebra fosters the belief that the only goal is the correct answer and that any intermediate step to “show work” is merely an attempt at partial credit in the event that the boxed-in solution is incorrect. It takes the better part of the first semester to convince students that writing up the solution to a problem is an attempt at communication.

In writing a sustained problem such as the long-answer portion of the Calculus Advanced Placement (AP) exam, I constantly stress three points (besides correct mathematics):

1. Use good prose including full sentences, connectors, capitalization, punctuation, etc.
2. Use a well-written solution that can stand by itself; i.e., a knowledgeable reader should be able to reconstruct the question from the write-up.
3. Use precise mathematical vocabulary.

The purpose of the following exercise is to stress the third point. My goal is to convince students that it is nearly impossible to engage in technical writing without the necessary vocabulary.

### *The Exercise*

The class is divided into two groups designated Group A and Group B (Figure 15–3). Each student in a group is given one of two complicated graphs with the following directions:

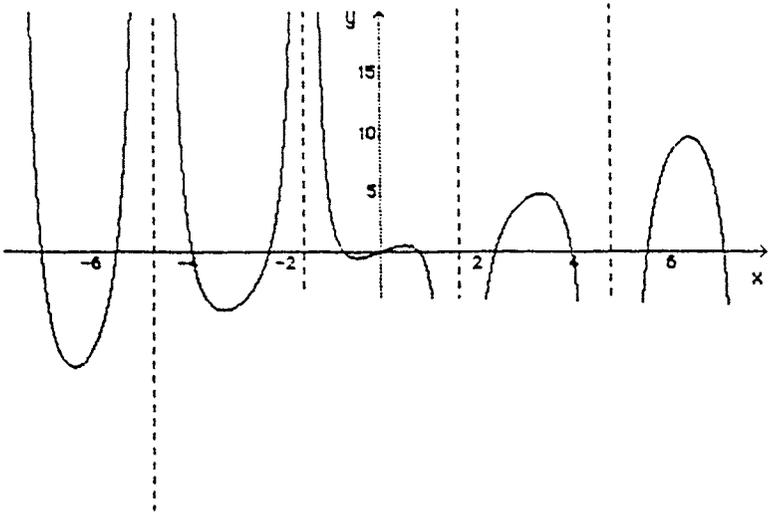
In the space provided below, write a well-developed paragraph describing the graph above to your reader. You must use descriptive English and may not simply list ordered pairs.

The following day, each student receives a description from the other group and must attempt to reproduce the described graph (Figure 15–4).

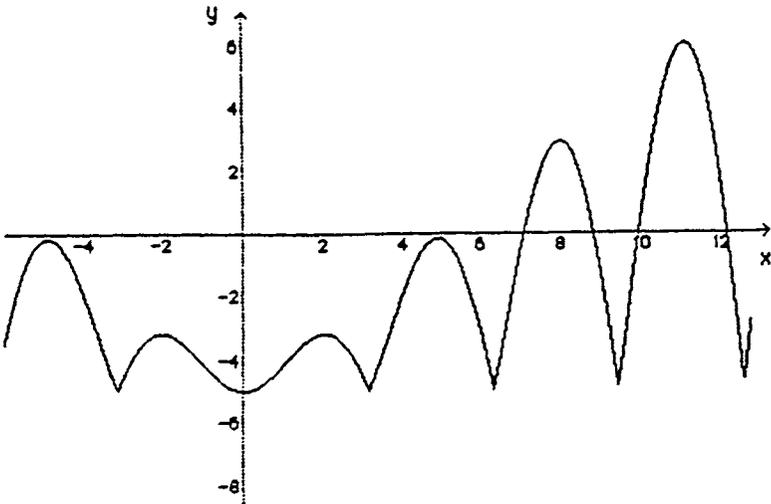
The message to the students about communicating without the necessary vocabulary comes through loud and clear. Out of eighteen Honors pre-calculus students, only one was able to reconstruct the graph described by his peer, and he admitted to a great deal of lucky guesswork. The point was made—in technical writing, each word needs to convey one and only one meaning, and that meaning must be the same for the writer and the reader. Use of metaphors describing a graph as “a series of sand dunes” or “like the arches of McDonald’s” left too much ambiguity to describe the reality of the graph.

After more than eight months of studying elementary functions, graphs, and vocabulary, students are again challenged with the same task. By the end of the year, the writing of the description (Figure 15–5) and the reproduction of the graph are deemed trivial by the students. The first year I did this exercise, the students were 100 percent successful (except for minor errors) in their efforts. They had learned to write to communicate to a particular audience for a specific purpose.

**Figure 15-3**  
Mathematical Vocabulary Exercise



A



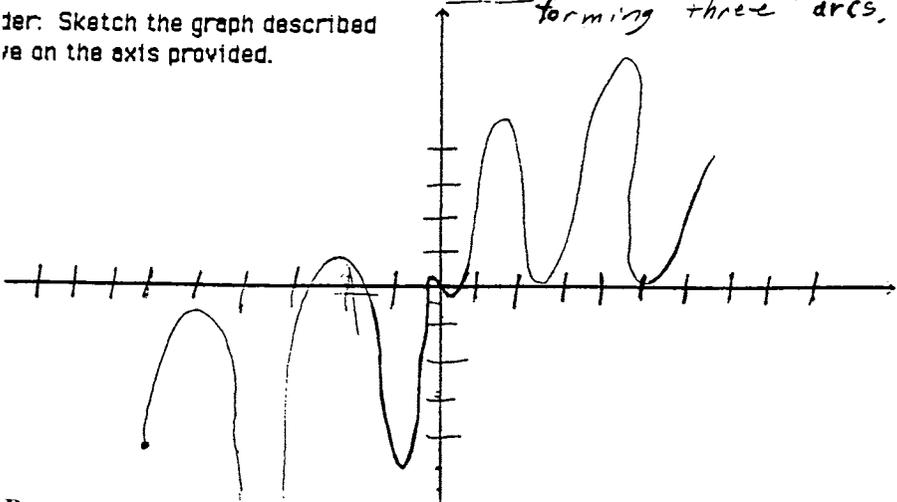
B

Figure 15-4  
Reproduced Graph

The line begins 4 points below the x-axis, & 6 points to the right of the y-axis. The line arcs up to, but does not touch, the x-axis at 5. It then arcs down to a point 5 points below the x-axis & two points to the right of the highest point of the arc. It then angles up to a point 2 points above the vertex & the angle it just created, & two points to the right of the x-axis. It then arcs down & crosses the x-axis at -5. Curving upward to points, it reaches the peak of its arc two points to the right of the y-axis. It then curves down to a point 5 points below the x-axis, a point to which it will return every three units along the x-axis. It forms arcs between these

reaching two points higher on each parabola beginning of the x-axis, to a maximum of 6 points above the x-axis forming three arcs.

Order: Sketch the graph described above on the axis provided.

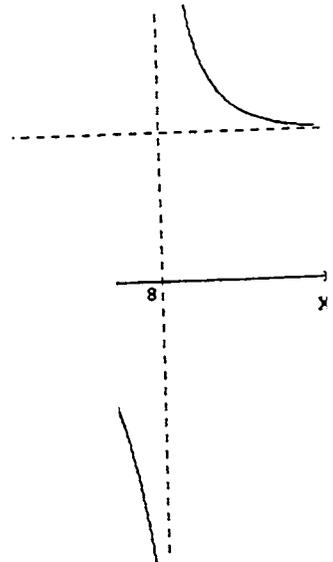
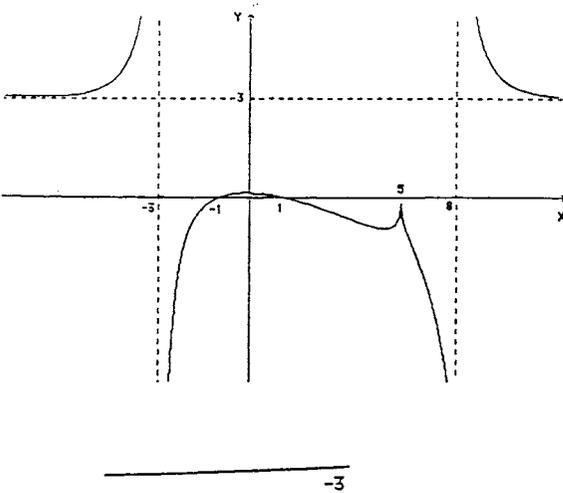


B

**Figure 15-5**  
Mathematical Exercise Revisited

The graph has vertical asymptote at  $x=8$  and  $x=-3$ .  
 Its horizontal asymptote is  $y=3$ , for both positive and negative  
 value for  $x$ .  $x$ -intercepts are at  $x=1$ , and  $x=-1$ .  
 $y$ -intercept is at  $y=0.2$ . There is a cusp pt at  
 $(5, -0.3)$ . Relative maximum is located at  $(-0.2, 0)$ .  
 Parity changes at  $x=8$ ,  $x=1$ ,  $x=-1$ , and  $x=-3$ .  
 Relative minimum is located at  $(4, -1)$ ; Other than  
 the cusp pt, the graph is nice and smooth curve

Yoshi Hishinur



## **Honors Biology Writing Projects (Peter LaRochelle and Pamela B. Farrell-Childers)**

Based on Pete's experiences in the lowland tropical rain forests of Ecuador in the spring and summer of 1991, he suggested that his students learn biology by creating alternatives to basic textbook learning. He felt that the intensive study of an ecosystem would provide an interesting context for the study of many biological concepts. Pete approached Pam with the idea of combining a more traditional approach to high school biology teaching with an intensive study of tropical biology as part of a year-long project using *Tropical Nature*, a collection of essays written by Adrian Forsyth and Kenneth Miyata (1984). This holistic approach would involve the development of a need for knowledge through discussing, questioning, and writing, followed by more intensive study of biological processes. In a sense we were testing a hypothesis that students would be more motivated to learn in this context and, therefore, would learn more. We agreed to offer the students possible writing projects to meet the objectives but also give them the option of creating their own learning project. The class met every Wednesday morning in the Writing Center to discuss the topics presented in each chapter and to see how the students' projects were progressing. All students were required to keep a journal documenting their writing activities.

Pam was primarily responsible for implementing the writing aspects of the course and for promoting discussion. Pete was responsible for guiding the discussion and touching on the critical points of each essay. Pam and Pete presented options to the students for their writing projects. The students selected their projects and wrote a description that included their direction, goals, and procedures. We gave them passwords and created computer file folders for each project within a master folder (LaRochelle) on the fileserver. The following projects were selected:

1. Articles to inform—Students would write articles for the school newspaper and for publication elsewhere to inform others of specific aspects of tropical biology.
2. Action letters to key individuals—Students would locate and write to key international organizations and individuals regarding specific political issues and environmental concerns.
3. Creative Writing—Students would write short stories set in similar environments to the rain forests described in the text and/or write poetry inspired by chapter content.
4. Theme writing—Students would write a booklet based on a year-long study of a particular aspect of tropical biology (one team chose opportunism; another, coevolution).

Branen and John described their goal “to become well-informed, maybe even experts, on the wide use of opportunism and the many contributions it has to the diversity of the rain forest and the survival of its inhabitants.”

Pete and Pam questioned each other and offered several “What if” questions to include in this new collaborative project. Also, we questioned students periodically to evaluate how they were doing and how we were doing as resources. As a year-long project, we gave students a two-part questionnaire at the end of semester one. Part One evaluated this program along several lines:

1. Did they perceive this approach as interesting and effective?
2. Did they have enough time to complete the reading, written assignments, and projects within the regular schedule?
3. How often should their progress be evaluated?

All students felt that although this approach was interesting and thought-provoking, there was too little time to complete their work with no scheduled time to work during the school day. In other words, this project could not be done *in addition to* the customary content goals of the course. We, therefore, gave them open time every two weeks when they were required to be in the Writing Center working on their projects. Finally, with the students’ approval we chose to evaluate their progress at the end of each grading period (each month) to keep them accountable. This part of the questionnaire also led to a detailed schedule (syllabus) for the second semester.

Part Two of the questionnaire aimed at our performance and their intellectual growth. When asked to share what they had learned “about biology, yourself, other new information,” one student wrote, “I have learned a lot about rain forests that I never knew. . . . The one thing I’ve learned about myself is that I can do a project like this without someone hovering over my shoulder.” Other students said that what they learned was “how little I’m aware of”; “I have to read to know what in the world is going on . . . I better start studying and reading more”; and “I want to preserve the rain forest and make others aware of the rain forest so they will want to preserve it, also.”

What have we as teachers of biology and writing learned? We have found support for our hypothesis (students would be more motivated to learn in this context and, therefore, would learn more). We also reached the following conclusions:

1. The development of a “need” to learn through reading and questioning sets an effective stage on which to learn biological science and models the more observational and investigative approach that students will experience in graduate research and professional work.

2. The selection of reading material is critical to helping the students learn many important biological concepts in a relevant and interesting context.
3. The thought processes lead to the research to discern design in nature and to the communication skills for students to express their own ideas and those of others.
4. The boundaries between disciplines are contrived and not real.
5. The study of biology can be more than microscopes, muscle types, and memory—it is the perception of design and function in nature that is not static but the result of many dynamic and integrated processes.
6. The study of biology necessarily involves verbal, quantitative, and historical aspects among others.

Writing to learn and writing to inform can effectively help students learn about the subject matter, the world around them, a self-directed project, and their own learning styles. We have learned from each other's knowledge and expertise. Pete shared his experiences through slides of the rain forests of Ecuador and his presentation of the subject matter in each chapter. Pam offered suggestions for writing and presentation of materials and parallel readings. For instance, when we covered the chapter on plants emitting toxic defenses against herbivores ("Bugs and Drugs"), Pam suggested that we all read "Rappacini's Daughter" by Nathaniel Hawthorne (1993) to see how accurate the author was in describing the poisonous plants. We both also learned that students were discovering how to write in new ways. Jeff, Rajeev, and Daniel had to learn how to write business letters using the school letterhead. Some used *Writer's Market* (1993) for the first time, and others had to make business phone calls to the Library of Congress and Tennessee Aquarium. Through WAC we have discovered worlds that each of us would not have traveled without the other.

### **Writing in Math or Math in Writing? (David B. Perkinson)**

How can writing reports on math articles or research papers on the history of math help my students become better math students? How can I cover the material I need to cover if I devote several days to writing reports and papers? Why should I change what I am doing in my classes to incorporate writing in my classes? As I began to investigate the idea of WAC, I discovered that these questions did not need to be answered. I thought of writing as a means to an end—simply the way students in the humanities communicated their ideas to their teachers. Fortunately, I came to understand writing is a much more dynamic

process than that. Writing is thinking. The process of writing develops ideas more clearly by slowing down the thought process. Writing requires a more thoughtful understanding and a better organization of ideas. Understanding writing as a way to think is the first step to understanding the benefits of WAC.

With this understanding of two levels of writing—writing to inform and writing to learn—came further questions. How can I use writing in my classes? Should I change my math classes to incorporate writing? Since it was easier to develop some writing exercises to use in my class than to change what I was doing, I started with a simple writing to learn exercise. While reviewing the homework problems in class, each student described his or her mistakes. Initially, students were not adept at correctly describing their mistakes, but I could still see the benefits of this exercise. If students could not describe the mistakes they made, they did not understand their mistakes.

As I read that first set of homework papers, I was convinced students needed time to learn how to write in this way. The writing required them to analyze their work in a way most of them had never done before. I also discovered that I needed to develop a more structured system for doing the homework so that they could find their mistakes the next day in class. I developed the idea of a double-entry journal to give them room to make corrections and describe mistakes next to every problem. I gave the students the following homework guidelines:

1. All problems should be done either in a column down one side of the page leaving space next to each problem or across the page leaving space below each problem.
2. As we reviewed the problems in class, the correct solution to any incorrect problem should be worked in the available space.
3. Students should attempt to find and circle the precise point at which they missed the problem.
4. For each mistake, students should describe as accurately as possible why they missed the problem.

In order for students to be able to find their mistakes, they must have well-organized, completed solutions to the problems (Figure 15–6). I used to plead with students to show their work. Some would do so reluctantly without any understanding of why they needed to do so. With this focus on homework, the students understand the difficulty of finding their mistakes if they do not show their work. Furthermore, the students see the benefits of doing homework, and they are more motivated to do it. The entire process is more meaningful to them simply because I asked them to write.

Recently, I began to require students to write questions about

Figure 15-6  
Double Entry Math Journal

WRONG DENOMINATOR

$$\frac{1}{(s+1)^2} = \frac{s-1}{(s+1)^2(s-1)}$$

$$\frac{1}{s-1} = \frac{s+1}{(s+1)^2(s-1)}$$

$$\frac{s-1-(s+1)}{(s+1)^2(s-1)} = \frac{-2}{(s+1)^2(s-1)}$$

27)  $\frac{1}{s^2+2s+1} - \frac{1}{s^2-1}$

$$\frac{1}{(s+1)(s+1)} - \frac{1}{(s+1)(s-1)}$$

$$\frac{1}{(s+1)(s+1)} = \frac{1}{(s+1)(s-1)}$$

$$\frac{s-1}{(s+1)(s-1)} - \frac{1}{(s+1)(s-1)} =$$

$$\frac{s}{(s+1)(s-1)}$$

their homework problems. If students cannot do a problem, they must write a specific question about the problem or state what they understand about the problem and at what point they are stuck. Instead of getting some homework papers with a few completed problems and an “I don’t understand” from students, I get evidence that they struggled with the problem. After writing their questions, the students have specific questions to ask the next day in class. Through the process of writing, the students are forced to analyze the problem as well as their own thought process.

As I began to see the benefits of these two writing exercises, I also began to see the importance of writing in other parts of my courses. These exercises not only involve using writing to enhance the students’ understanding of mathematical concepts but also provide me with valuable feedback. The writings give concrete examples of the level of understanding of each student. This honest feedback from the students is the best way to analyze my teaching performance. I can also use the writing exercises to establish a dialogue with the student. Thus, writing to learn exercises in mathematics enhance the learning process for both teacher and student.

Other exercises that can be used in math classes include the following:

- Write a cooperative problem-solving report.
- Submit a math column to the school newspaper.
- Have each student write his or her math history.
- Have students write letters to each other explaining a concept.
- Allow students to bring summaries of each unit into the test. The summaries could be written at the end of each unit in class.
- Have students keep journals on their progress in math: attempts, failures, difficulties, feelings.
- Have students write short stories about mathematical concepts.
- Ask qualitative questions such as: Which method is better? When is it better?
- Have students write their own descriptions of mathematical concepts.
- Write word problems.
- Have students write reports on articles pertaining to math from news magazines.
- Research the history of math.
- Draw a figure, have one class describe it, and another class draw it from the descriptions.

## Words and Images (Catherine Neuhardt-Minor)

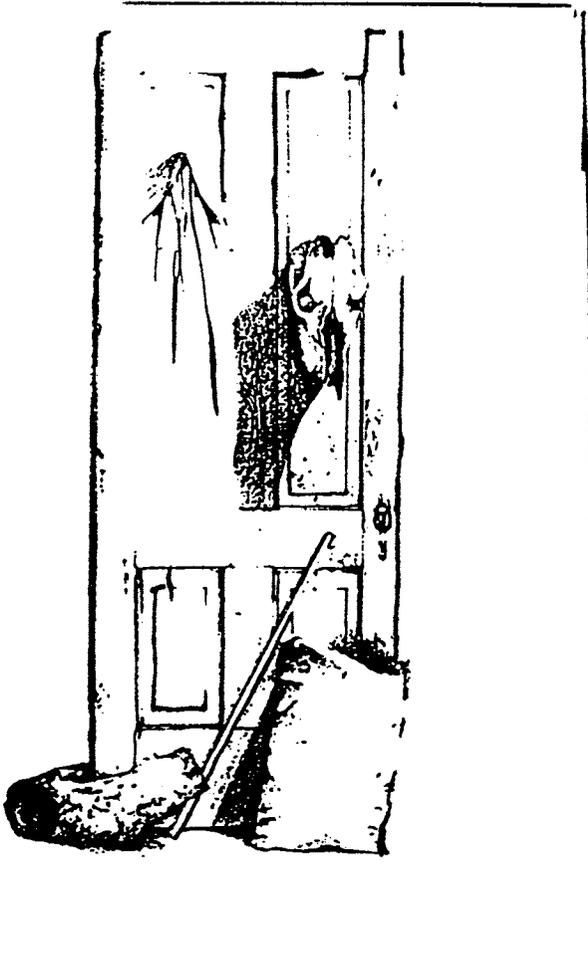
Students in Art I have no trouble telling you whether they like or dislike a work of art, but they rarely can tell you why. What they are responding to is the total impression of the work. Writing, in conjunction with making art, focuses students' attention on specific details. Verbalizing these details places newly found information into familiar vocabulary. Students are able to talk about directional forces, light sources, and relative values because they have ordered their thoughts enough to write about them. "There is a hat placed to the right of the door with a shadow that tells of a light source shining on the door and its objects," Dan Chandler explained in his critique of the illustration in Figure 15-7. Having to write about a piece of work also forces the students to observe details they might skip over in a casual conversation.

**Figure 15-7**  
Illustration Critiqued by Chandler

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**Figure 15-8**  
Picture Critiqued by Buckner



This is a picture of a door. There are two objects hanging from the door. One is a jacket, the other is a cow skull. These objects are hanging from top left (jacket) and top right (skull). There are three objects at the foot of the door. There is a log, a wooden broomstick, and a large sack. The stick is propped at an angle toward the sack. The log is on the left side of the door. The door is old. It has no door knob; it is cracked and looks as if it is fragile. There is shadowing to the bottom left side of all the objects except the jacket. The jacket is not complete. (David Buckner, critique of Figure 15-8)

This kind of objective reporting sharpens the students' observation skills and leads to more detailed and thoughtful renderings. This not

only makes them better artists but also helps them to appreciate and evaluate the work they have just created.

Critiques of still lifes, as well as other artworks, are especially useful when a whole class is working on the same exercise. For instance, critiques were written by two students about different drawings of the same still life (see Figures 15–7 and 15–8). What is especially gratifying is the way their direct observation leads to the use of imagination and self-revelation:

This is half finished, but still it is beautiful. The artist took his time and paid close attention to detail. If we pay close attention to the things we consider small and unimportant, even if we don't finish our main goal in life, we still have produced a beautiful picture. A picture that is probably more beautiful than that of a rushed sprint to the big goal. (David Buckner, critique of Figure 15–8)

Words not only describe but also may be used to stimulate the creation of images and indeed entire compositions. To introduce this idea, I give each student a large piece of paper and several oil pastels of various colors. I then ask them to “draw” the noises I make, using an appropriate color. At first no one believes that they can draw a sound, but after experimenting they are quite pleased with the results. This new skill of translating noises to marks on a page is then extended to sounds and words. A discussion of Poe’s “tinnabulation” and Kandinsky’s synesthesia further integrates the students’ understanding of words, sounds, and images. Using writing to learn activities gives both student and teacher visual and literal insight into themselves, their world, and the world of art.

## Conclusion

The McCallie teachers have learned a great deal about themselves and their students through the use of writing to learn activities in their classes. Cissy discovered how her exercises “allow students to unburden themselves, to feel that they have a right to their opinions, and to have the fulfillment of helping someone else.” Lance’s students have “learned to write to communicate to a particular audience for a specific purpose.” Through their collaborative work, Pete and Pam “have discovered worlds that each . . . would not have traveled without the other.” David realized that his “exercises in mathematics enhance the learning process for both teacher and student.” And, finally, Catherine has expanded the horizons of creativity of her art students through writing. Every new writing to learn activity will bring new discoveries for both students and teachers. The possibilities are infinite.

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