
**Write On! Math: Note Taking Strategies
That Increase Understanding and
Achievement
3rd Edition**

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INTRODUCTION

WHY FOCUS ON WRITING IN MATHEMATICS?

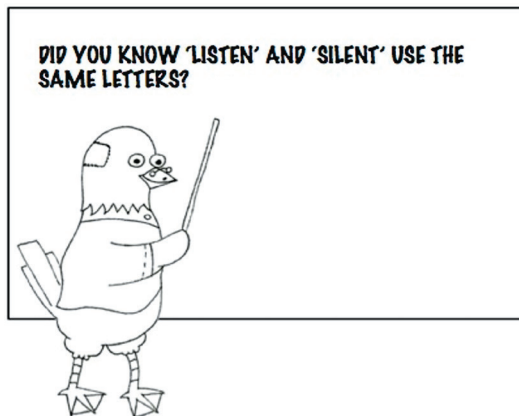
TO THE TEACHER

Calculators. Computers. E-mail. EZ pass. Text messages. Voice mail. Tweets. Cell phones. Tablets. Microwave ovens. Isn't it incredible how all of these time saving inventions have not reduced stress? How they might actually *increase* stress?! Most people today would say they are busier than they were years ago, and doing more multi-tasking, in spite of all these "time-saving" conveniences.

Classes. Homework. Reports. College applications. Sports. Clubs. Plays. Internships. Jobs. Research projects. Fund-raisers. Music practice. Most teachers agree that today's students are more frazzled than their counterparts who, years ago, did not enjoy such a wide variety of commitments and activities.

When you add the Common Core State Standards, high risk-testing programs, and competing for college entrance to the mix, there is a perfect storm created that makes school more stressful for teachers and students.

Let's face it. Everybody's busy! Given that, it is imperative that teachers and students alike maximize the output they get out of the time they input. Daydreaming in class is an extremely poor use of time. It leads to frustration with the homework, added extra-help sessions, a feeling of falling behind, and possibly a lack of confidence. When the student is in a captive audience (a class), they should use their time constructively. How can we help them do this?



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Students are always asking, “What can I do to improve?” Too often, it is asked after poor results on a test. At that point, students often ask to do extra credit projects to bring up their grade. It is ironic that they are looking for “extra” work when they have not mastered the required work. Improvement must take place *before* the test. Another popular student comment is, “I know it when you do it, but...” (Translation: The student doesn’t know it). In the late 1980s, Sarah, a very successful student of mine, was asked by other students, “How are you so successful?” She told them that she was totally focused during class, and worked diligently on her homework. If you are sitting in a class, and have to do homework, do a thorough, comprehensive job while you are engaged in those tasks. This formula is so simple—if you have to spend the time, spend it wisely. Otherwise, you’ll just have to spend even more time playing catch-up. If you are eventually going to be held accountable for the material, concentrate when you are working on it. If you don’t, you’ll just be creating the need to spend even more time mastering the material. It all makes so much sense!

We now have established the fact that people are busy and need to spend their time more productively. Focusing during class should be a paramount objective. How can we, as teachers, help students be more focused in class? We need an activity that requires them to be “on the ball” throughout the entire class. This should be an ongoing *activity*—not a punishment, threat of a test, or disciplinary action. The students need to be accountable for the completion of this activity. They need to see that it breeds success; that it helps them improve. *Write On! Math* is a program that has the potential to keep your students engaged in an on-going project that will strengthen their mathematics and teach them technical writing skills. *Write On! Math* is a program that will teach students systematically how to take better notes in math class. Total concentration is a prerequisite to learning how to take better notes. Therefore, a by-product of taking better notes is staying focused in class.

Possibly, as a teacher, you at one time remarked to a colleague how you understood something better (or even for the first time!) when you had to teach it. There is no better way to ensure you know something well than to have to teach it to somebody else. The *Write On! Math* program requires students to do exactly that—that is why it improves their mathematics as well as teaches them a valuable writing technique not taught in English class. *Write On! Math* will improve the way you present material to your students in class and on your handouts.

We suggest that you read the entire book to understand the scope of the program. After you have read the book, consider these suggestions:

- If you present lessons with PowerPoint, take note of a few subtle, but important nuances. When you write a sentence by hand, the students have time to copy it down since it took you time to write it. They also get to see how people create and revise sentences and organize thoughts into full sentences. We will call this

“real-time writing.” Instant PowerPoint sentences rob students of witnessing this essential, creative facet of good writing. They only get to see slick, pre-packaged, revised sentences. They also often don’t have time to copy them down since the teacher starts talking about something after the sentence is clicked up, since the teacher doesn’t have to physically write the sentences in real time. PowerPoint presentations look good, but they hinder the development of better writing skills in a mathematics classroom setting.

- As you encourage students to write down items that are not written on the board, but said in class, you might decide on some sort of signal to indicate to the students. “*Write this down, even though it’s not on the board.*”
- Try some of the writing activities on your own before you try them with your class.
- Present a lesson on two sides of the blackboard, or on an interactive whiteboard in two separate files. Make one side or file the “No Annotations” version, and the other side the “In-Class Annotations” version. Let the students see the difference as the lesson progresses. Taking better notes is not an innate skill any more than using the Law of Cosines is—note-taking skills can be taught.
- After showing students how to write “In-Class Annotations,” present an “At-Home Annotations” or “Balloon Help Annotations” version of the same lesson that you can develop with them, or do on your own in advance. Point out the differences.
- You may want to do your own Math Author Project on a specific lesson, and hand it out to the students the day after you teach the lesson. You can even do a Math Author Project on the lesson that they students used when they were exposed to In-Class and At-Home Annotations. You should do this after you teacher the writing tips, so students can see how the tips are implemented.
- You can start a website of completed Math Author Projects. If you assign each day to a different student, you will be building an entire year of notes that students can use to study for midterm and final exams. Give students a few weeks to complete each lesson, since the Math Author project is not an overnight assignment.
- You can request that students hand in paper copies of their Math Author project. Create a binder of the entire year’s notes this way. Students who are absent or who want to photocopy notes can sign out the pages they need.
- You can request that students also submit an electronic file of their Math Author Projects, that can be made available to all students in a folder on your school’s server, or on a website.
- You can cooperatively create a Math Author Project with the students, right on the computer, projected in class so they can see it developing. Let students offer suggestions as the development progresses.
- You can assign writing activities as part of the homework each night. You can ask students to develop a specific problem you assigned as an At-Home Annotations project.

- The Common Core Standards for Mathematical Practice stress a student’s ability to explain their work. When writing is consistently applied all year and for the entire mathematical content of the course, students internalize the procedures and it becomes a natural part of their problem solving.
- Students looking for “extra credit” assignments can be asked to do Math Author Projects. The beauty of this is that the student has to carefully review and explain the required mathematical content of the lesson they choose, so it makes them stronger in the required course content. It provides the teacher with a worthwhile extra credit option.
- Show students in subsequent years the best Math Author Projects from previous years. This will “raise the bar” for each new class—the students will view those excellent projects as the required norm.
- You can have students present their work as part of an end of the year review. You can videotape their presentations for future students to view.
- Students can record narrated PowerPoint presentations based on their Math Annotation Projects and make them available to the entire class via a folder on the school server or a teacher’s website.

TO THE STUDENT

You might never have thought of the role writing should play in your mathematics classes. My students have been doing writing projects in my mathematics classes since 1977. Why? Writing is a component of every facet of our world. Everyone needs to know how to write. All professions require communication; none of us operate in an isolated vacuum.

You might feel that mathematics and writing form an “odd couple.” How do mathematicians communicate their findings? The same way your doctor does, your teacher does, your plumber does, your babysitter does, etc. They talk. They write. They use visual aids. They must be able to communicate their thoughts clearly.

Were you ever absent from class and asked a classmate what you missed and they replied, “I know what we did but I can’t explain it.”? Imagine if your car was fixed and you asked the mechanic what was wrong and she responded, “I fixed it but I can’t explain what was wrong.” How would you feel if you went to the doctor’s office and your doctor said, “I know what’s wrong with you but I can’t explain it.”? How much confidence do you have in these responses?

Mathematicians must be able to communicate their findings so the results can be used to solve future problems. As you read through these sections and lessons and start your mathematical writing journey, you will be exposed to pages written by high school students just like you. You will read their work and see how well they have learned the art and science of communicating technical material. With effort and practice, you will become a pro at it, too!

STUDENTS HELPING STUDENTS: ACKNOWLEDGMENTS

In 1991, North Shore High School in Glen Head, New York made a concerted effort to improve students' mathematics writing and note taking. These students have learned about mathematics, writing, and writing mathematics. Over the years, students from many high schools all over the country joined us on this technical writing journey. This book would not be possible without the fine work of these students. They have improved their note taking considerably and samples of their work have been included throughout this book.

For all they have learned, and all of the marvelous work they have done, I think I have learned more about teaching and writing because of them than they learned from me! Meeting with them one-on-one, and reading hundreds of drafts from each student every year has made me very keenly aware of the types of errors students make as they try to improve their writing, and how these errors can be avoided.

Everyone who benefits from *Write On! Math: Note Taking Strategies That Increase Understanding and Achievement* can join me in thanking these fine young scholars:

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You supply the talent, effort and practice, and we'll supply the instructions in this book. You'll produce quality work with a ton of pride. You will also be much better prepared to handle writing assignments and oral presentations in college and in your career!

