

## **Mathematics through Language**

Allen Lambert, MEd

Middle Years Program Teacher, Wellspring Learning Community, Beirut, Lebanon

allenl@wellspring.edu.lb

### **Abstract**

This workshop explored the importance of mathematics in written and oral language development. Mathematics has its own unique words and expressions, but is learned through a student's natural language. Writing in mathematics can help students grasp concepts better, explain and assess their thinking, and bring more enjoyment to the subject. When a student writes about math, he/she gains a deeper understanding of what he/she knows and is able to do. In the workshop we explored the following questions: How does writing in mathematics develop language? When should students write in mathematics? What does good mathematical writing look like? How can mathematical writing be used to assess students? Participants analyzed an article, investigated lesson ideas, reflected on student work, and generated ideas for their own practice.

### **Introduction: How is language developed through the use of writing in mathematics?**

Traditionally mathematics has been taught through repetition and memorization. Classroom practices must be transformed by teaching concepts and strategies through meaningful learning experiences. The use of language and specifically written language in mathematics is a valuable paradigm switch in teaching and learning. Instead of assessing the right answer to a problem, teachers should assess the ideas and the strategies behind finding the solution. To solve a problem in mathematics students need to use their language skills to comprehend the problem, reason the best strategy for solving it and to communicate how they found the solution to others. Integrating writing into this process allows the student to be reflective of their understanding and abilities.

Studies show that effective teaching in mathematics includes a focus on the development of conceptual knowledge and language that requires the teacher to use clear and understandable dialogue with the students. This supports them in learning new ways of expressing their thinking and models the appropriate uses of the mathematics register; the use of the special vocabulary that is particularly to math as well as natural language. Even natural language takes on special meaning within the mathematics register. Everyday words may be transformed or broadened to include new meaning peculiar to the concepts of mathematics. At times, students may struggle with understanding concepts described within the mathematical register. Integration of writing allows for more exposure, repetition and reflection on the use of the appropriate register while students are developing their natural language.

### **Benefits and challenges of using writing in mathematics**

Most educators were taught mathematics through traditional means, yet recognize the need to be more progressive in their own teaching practices. Conceptual based teaching and the integration of disciplines benefits the learner. This requires action research, innovation, sharing of ideas, the battling of misconceptions and collaboration. Transforming teaching practices in the classroom requires taking risks and spending more time in preparation and planning. In addition, when students write in mathematics, more time is needed to read and reflect on their work.

There are many ways that writing and mathematics can be integrated. Students can write short reflections or explanations of their problem solving, which can make over a more traditional approach to teaching math. They can be incorporated into an interdisciplinary unit project. Mathematics can be used as a theme for creative writing. Some of the more practical math writings can be journals or logs, writing about the strategies used during the problem solving process, writing about understanding of concepts, and writing about feelings or attitudes towards math. Each form of writing has its purpose and value. Writing can be used to bring enjoyment to the subject or to reveal the knowledge and misconceptions a student may have.

## **Understanding the Approach**

Workshop attendees read article selections and shared their reflections with the group. Half of the attendees read an article by Gilberto J. Cuevas. Cuevas asserts that the student's ability in language not only determines performance in mathematics but also in the acquiring of conceptual learning and therefore is an integral part of the teaching process. Although there is not a clear understanding of the relationship between language factors and mathematical achievement, research has shown that there is a correlation between mathematical achievement and reading ability. This speaks of the need for language development. Teachers must support students in their development of written and oral language and be mindful of the students in the class that need additional support in this area. Mathematical language has its own functional register. It is important to help students develop the language so that they can adequately describe the problem solving process and explain their thinking. They must use a combination of mathematical terms and expressions along with their natural language to communicate effectively. Their ability to understand and share their thinking helps them in processing their reasoning. Naturally, language has a role in assessment.

The other half read an article by Dr. Marcia Frank. Frank concluded that integration of writing with mathematics is integral for teaching concepts. Although there are limitations to how writing can be used, it is one of the best ways to assess whether students understand the concepts and the process of the mathematics learned in class. It is a means to conference with each individual student when time is limited. It is through their writing that students can demonstrate what they know and what they can do. By asking students to respond to simple writing prompts, much of their understanding can be revealed.

Following the analysis of the articles, we focused on how different forms of writing can contribute to helping students process their own reasoning, demonstrate their learning and develop their language skills. The use of journals can help students reflect on their learning and monitor their growth. In class writing prompts can assist in working through a process, communicating to the teacher individual needs and demonstrating understanding of a newly learned skill. Portfolios are also great for monitoring growth and to give the students an opportunity to highlight work that they are proud of. Graphic organizers can be useful in developing vocabulary and working through a problem solving process. In everyday class work, homework, test and quizzes, writing can be incorporated to develop language and make the task more enjoyable for the students.

Attendees also looked at some sample student work from an international school in Beirut, Lebanon. The artifacts represented various types of mathematical writing. Participants were given a rubric to assess the work. This activity was followed by a discussion of how to assess mathematical writing and the useful data that can be gained from it. Finally, attendees were asked to reflect on their teaching practices or the practices of their teaching community and set goals for the future.

## **Conclusion**

Students are expected to use language appropriately when communicating mathematical ideas, reasoning and findings – both orally and in writing. Through mathematics students have access to a unique and powerful universal language while developing their primary academic language. Students should be able to communicate a coherent mathematical line of reasoning using different forms of representation when investigating complex problems. Writing in mathematics is integral to working through a process, communicating to the teacher individual needs and demonstrating understanding of newly learned skill.

## **References**

- Andrew Sterrett (Ed.), *Using Writing to Teach Mathematics*, Mathematical Association of America, 1992.  
Dr. Marcia Frank, *Writing in Math – Should it Have a Home in Today's Curriculums*, University of Maryland, 2001.  
Gilberto J. Cuevas, *Mathematics Learning in English as a Second Language*, *Journal for Research in Mathematics Education*, Vol. 15, No. 2, Minorities and Mathematics. pp. 134-144, Mar., 1984.  
Bernadette Russek, *Writing to Learn Mathematics*, *Writing Across the Curriculum*, Vol 9, August 1998.