Improving Student Understanding of Math Textbooks Through Online Graphic Organizers

Carla Bacon
Department of Educational Studies
St. Mary’s College of Maryland
United States
cjbacon@smcm.edu

Lin Y. Muilenburg
Department of Educational Studies
St. Mary’s College of Maryland
United States
lymuilenburg@smcm.edu

Abstract: Due to an increased focus on achievement within reading and mathematics it is necessary to do all that we can to help students succeed. However, since mathematical understanding is influenced through the ability to understand mathematical text, students need to be taught how to correctly read and synthesize information within a math textbook. This paper examines the use of the online mind mapping tool webspiration as a method to increase student organization and understanding of written mathematical information.

Since the implementation of No Child Left Behind, schools have begun to focus on mathematics and reading in an effort to meet the requirements of the state. However, it is difficult to make progress in mathematics when students lack ability to read the math content. According to Jones (2001), many students who are performing below grade level have the most difficulty reading within content areas. This fact is not surprising as Fite (2002) reveals that previous research has proven a student’s mathematical achievement is correlated to that student’s language proficiency. In order to improve mathematical achievement, one would think it would be necessary to increase language and literacy practices within the content classroom. Unfortunately, despite an appeal to increase literacy practices within secondary classroom, teachers have been reluctant to comply (Draper, 2002).

Teaching literacy practices alone however will not suffice. While reading and math are correlated, the reading performed within the math classroom varies from traditional language arts reading. Within math, instead of “learning to read,” students are required to “read to learn” at even more difficult levels (Jones, 2001). Additionally, within content reading, students are required not only to read, but to also decode symbols, interpret illustrations and read a textbook that is organized differently than the textbooks for other subjects (Barton, Heidema & Jorda, 2002). In order to accomplish these requirements, students need help. Therefore, students need to be taught not only how to read the math textbooks but also how to use the textbooks as resources (Fite, 2002). Until these skills are taught, students may be unable to successfully navigate a mathematical text. Fite found further support for teaching mathematical reading through showing that students who were explicitly taught how to read math increased their problem solving performance.

Therefore, in order to increase student’s ability within mathematics and their understanding of the text, teachers must begin to teach students how to effectively read and understand mathematical text. As Draper (2002) states,

“Moreover, when mathematics teachers attend to the literacy needs of their students – their needs to make meaning (construct knowledge) as a result of their interactions with mathematical texts – they are doing their jobs. A mathematics education that assumes to prepare students without providing them with access to text falls short of truly educating students. Literacy activities, designed to help students negotiate and create text, can be adapted for use in math classrooms.”

In order to address the lack of mathematical text instruction and the necessity of teaching students how to effectively read a math textbook, this paper will examine using online organizers to increase students learning and understanding of the text.
Solution

A solution to the problem described above can be found using the online mind mapping tool *webspiration*. *Webspiration* is available to any individual however specific *webspiration* classrooms can be purchased for grades 5 through 12. Students can form their own accounts under the teacher’s *webspiration* account with no downloads necessary, simply access to internet and a web browser. If interested, an entire school can purchase a *webspiration* account that allows for all students and teachers within the school to create their own *webspiration* classrooms.

The reason *webspiration* was chosen over various other online tools was due to the classroom security of the website as well as the multiple functions that the domain covers. *Webspiration* classrooms are secure locations in which only students and teachers can view an individual’s work. In addition, this online tool automatically saves and organizes a student’s work so that files will never be lost and can be accessed from any computer at any time. Through the connection between the teacher and students, students can also share files for classmates and teachers to comment and review. With the approval of teachers, students can also work with classmates to collaborate on the same organizer or prepare for an upcoming project. To guide student’s learning, teachers can also share their own personal organizers as examples or study tools. Lastly, *webspiration* is a great tool for all types of learners. Graphic organizers and pictures can be created for visual learners and, with a click of a button, the organizer can be transformed into an outline format for those students who learn better by reading. The ability to save files, open from any computer, collaborate with students and teachers, and expand learning past the traditional school hours are all reasons why *webspiration* will be a great addition to any classroom.

Online graphic organizers are beneficial for several reasons. First, graphic organizers have proven effective in increasing student’s understanding of written mathematics. By providing the students with a framework of how to organize the written words students can slow down their reading and fully engage with what is being stated (Braselton & Decker, 1994). Additionally graphic organizers can be helpful for all students, including those with learning disabilities. By modifying graphic organizers to include not only words but numbers and equations to help remember steps, students with learning disabilities had a better understanding of the mathematical foundations necessary to solve equations (Ives, 2007). With an increasing importance on classroom inclusion of all students, these organizers may become essential within the classroom.

The online component of the graphic organizer is crucial to success as well. To start, putting the graphic organizer online means that it cannot be lost within a student’s backpack or folder and will be readily available for use at all times. In addition, with *webspiration*, a student can download and print their graphics if necessary. Online graphic organizers are also easy to modify or revert back to previous versions. Furthermore, technology implementation within the classroom benefits student’s learning. Hopson, Simms and Knezek (2002) found that technology integrated classrooms increased student’s acquisition of higher order thinking skills. The benefits of technology usage are also supported in another study in which students who used technology within the classroom displayed stronger content performance (Krentler & Willis-Flurry, 2005). Lastly, in a study conducted by Li (2007), while teachers were sometimes apprehensive of including technology within the classroom, secondary students were enthusiastic about using technology as a mode of learning motivation, confidence and preparing for a technologically advanced world.

Example Lessons

Following are a few examples of how *webspiration* could be integrated into mathematics instruction. One example is to help students outline key vocabulary within a mathematical textbook chapter. Teachers can administer to students a blank graphic organizer template and require students to fill in the appropriate blanks for all important vocabulary they encounter in their reading or throughout the unit. Students can then electronically submit their organizers to the teacher for grading or can simply share with the teacher to comment or check for completion. Figure 1 depicts a graphic organizer started by the teacher that students can complete during reading.
Teachers can also use graphic organizers to assist students in learning about the history of mathematics. While mathematical history is often not written into the mathematical curriculum it is an important aspect of math that can be introduced. The book *Is God a Mathematician?* by Mario Livio discusses many prominent mathematicians while engaging the reader in determining whether math was invented by man or a fundamental occurrence of nature. Using excerpts from the book students can be assigned various readings discussing philosophers and mathematicians while learning the interesting and unique ways mathematics is seen in everyday life. While reading excerpts students can create outlines detailing what they read. These outlines can then be shared across the classroom for students to obtain information without reading the entire book. For those students who may understand material better in a visual manner they can easily convert the outline into a graphic organizer. Figure 2 depicts the same information from the book in both outline and graphic form.

A final example of the use of a graphic-organizers is to outline the steps required to solve a problem. Figure 3 shows the steps for analyzing the graph of a polynomial. Copies of these outlines could be distributed electronically to the students the evening before class. Students could then review the steps and have a quick step by step outline of the mathematical concept without being distracted or overwhelmed from the textbook's explanation.
Figure 2: History of math depicted as an outline and as a diagram.

Figure 3: Outline of mathematical steps
These are only a few examples of the many applications of webspiration into the mathematics classroom. To use webspiration, a teacher must first either register for a free 30 day trial or purchase a class subscription of the webspiration classroom. A tutorial should be provided to the students on how to access webspiration from any computer and how to effectively fill out or create a graphic organizer. Over the course of several weeks students should receive decreasing feedback on their graphic organizers as they gain autonomy and responsibility of their learning. Meanwhile, the teacher can observe and record student progress and student’s reactions to the online organizers.

Conclusion

Implementing the use of online graphic organizers in mathematics classes has the potential to improve students’ ability to read and decipher mathematical texts and increase overall understanding of mathematics. Ideally students’ understanding will increase as well as enhance students’ ability to explain the math in their own writing. While the development of graphic organizers may lengthen the reading process, the benefits of understanding and the excitement of using online organizers will increase student’s satisfaction with mathematics.

References


