MATH SPEAK AND STUDENTS' JUSTIFICATIONS PROMOTE DEEPER UNDERSTANDING OF MATHEMATICS CONCEPTS

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Introduction

"Talking during math class? You mean you actually want us to talk during class? This must be a trick! Our teachers must be going crazy!" These are the thoughts going through our third graders' heads here at John Kerr Elementary School in Winchester, Virginia. This year, math class has been different than in many previous years for both teachers and students. After attending professional development sessions and learning about the importance of "math talk," we have revved up our conversations in math class. Students are now encouraged to share their thinking, and how and why they arrived at their final answer. We have witnessed first-hand the positive impact this has had on our students' depth of knowledge and mathematical understanding. Our team collaboration, the restructuring of our students, and the components of our lessons have contributed to the increased level of success in our classrooms.

Team Collaboration

They say it takes a village to raise a child and here at John Kerr we are no different. We believe collaboration among our team members and other support staff within the school has directly impacted the success of our students. It truly is a team effort and our district motto "Learning For All, Whatever It Takes," is evident in our classrooms.

We are a four-person team in which each teacher is responsible for planning lessons for a specific content area. From making Smart Board™ Notebooks, *PowerPoint* presentations, counting copies, or pulling manipulatives for each classroom, the Mathematics Specialist ensures we have all the materials to teach that day's lesson.

This format allows us the opportunity to have four "experts" on our team who dedicate all of his/her attention to producing effective, differentiated, and intriguing lesson plans. Joe Svoboda is our own math expert. The additional time this planning method allows has led to an increased focus in the inclusion of higher-level thinking problems, collaborative activities, and application problems within our plans.

In addition, we meet at least three times per week to discuss our plans and to reflect on lessons taught. We feel reflection is an essential part of our lessons to adjust our instruction and

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make continuous changes to best suit each student's needs. Our weekly Professional Learning Community meeting includes the following personnel: an administrator; other support staff, such as the English as a Second Language (ESOL) teacher or reading specialist; and, a rotating specials teacher (Art, Music, PE, Library). During these meetings, we discuss student strengths and weaknesses, as well as strategies to use for instruction. This process has increased our ability to provide individualized instruction and intervention for students.

John Kerr is an open school which presents certain benefits. Our pathways into each other's rooms allow us the opportunities to team teach or peer poach (observe) with our closest neighbor. The collaboration extends beyond the grade 3 realm. Walk into any room at our school and you will see mathematics at work. In art, our students can be seen working on geometrical figures and angles; in music, patterns; in the library, ordering numbers; or, students may be seen skip counting in PE. At John Kerr Elementary, it really does take a village!

Restructuring Math Time

We have a ninety-minute block of time for mathematics instruction. Usually that includes forty-five to sixty minutes of whole group and forty-five minutes of math workshop (differentiated grouping). In order to meet the needs of our students, we have restructured our math groups. During our weekly Professional Learning Community meeting, we identify students that typically struggle in math, but who would be capable of mastering the content if they received continuous individualized instruction on their pace. These students are all moved to our "experts" class for the entire scheduled math block. Who better to teach them than the person responsible for planning our lessons! Joe's homeroom is then divided among the rest of us. We feel this way of differentiating our mathematics instruction meets the needs of all of our students and provides an optimal learning environment.

The restructuring of our math time has allowed us to provide quality instruction at an appropriate pace for each of our students. Caryn Glassbrenner, Pat Hollins, and Sam Vance provide mathematics instruction on pace with our mathematics curriculum. During our math workshop block, we include differentiated grouping with the same group of students. Just next door, Joe provides instruction on a pace which is needed for his specific group of students. During a typical week, he is two to three days behind the rest of the grade. This is an example of why our collaboration is the key to success. In addition, all support staff (aides, intervention teachers, etc.) are sent to Joe's room to provide additional individualized instruction to these students. We have found this process has led to higher test scores on our classroom and district

benchmark assessments, and has increased student understanding of content. By providing additional opportunities and time with concepts, students who have struggled in the past are now able to understand and explain their thinking.

Incorporation of Math Talk

One focus of our school this year has been to increase time for "math talk." We are encouraging math talk by providing students more opportunities to convey their mathematical thinking in written and verbal form, incorporating the greater use of mathematical vocabulary within lesson planning, and using guiding questions to encourage students to communicate about mathematics in ways that address the *Mathematics Standards of Learning* (*SOL*) process goals for students [1].

Critical to developing our understanding of how to encourage math talk have been Virginia Department of Education (VDOE) resources, including documents on its website and the Principals' Partnering Institutes offered under the auspices of the Virginia Mathematics and Science Coalition. After our principal, Nan Bryant, attended the VDOE Principals' Partnering Institute during Fall 2011 and the winter of 2012-13, she brought back articles for our staff to read and study together, resources from VDOE, and activities for practicing math talk during our staff development meetings at John Kerr Elementary.

Bryant says, "I credit the teachers for taking the initiative to increase math talk from there. The teachers embraced the connection between achievement and students demonstrating ownership of their learning through math talk." She also noted, "Teachers are seeing the benefits of the instructional strategies and resources made available through VDOE as students display increased depth of knowledge during math class."

In order to provide students more opportunities to convey their mathematical thinking, we are including math talk as a key component in our lessons. Students are frequently asked to share with a neighbor how they arrived at their answer or to write an explanation. We have reduced the number of problems given during our lesson and increased the time for students to share their rationales with the class. Often, students are asked to teach some part of our lessons to their classmates. They are able to explain what the problems are asking, provide step-by-step explanations of their mathematical thinking, and defend their final answers to the class with very minimal prompting. We have observed students enjoying multiple ways to solve problems and developing their own strategies to solve increasingly rigorous problems. This has led to a deeper

understanding of the content and an ability to apply the mathematics skills to real-life problems. Students can create a variety of responses through collaboration and math talk when asked to solve a multiplication story problem (see Appendix A).

We have also increased the amount of time spent on mathematical vocabulary. Students have their own math glossaries to which they add their own definitions, examples, and pictures of mathematical terms. We play many math vocabulary games to help students retain understanding of mathematical content. For example, a favorite game in our grade is a mathematical version of Pictionary™. On one slide is a brainstormed list of all math words we have discussed so far this year. Volunteers from teams come up and pick a word to draw. Teams must guess the word and share how they know it was the correct word to win a point. This is one activity that encourages students to think about what the words mean and explain their thinking in choosing answers, rather than simply guessing.

Support from administrators has allowed us to encourage math talk within our rooms to an even greater extent. After multiple professional development meetings concentrated on increasing mathematical understanding for our students, our administrative team provided us with guiding questions to use with our students. These questions are derived from the five mathematics process goals in the *Mathematics Standards of Learning for Virginia Public Schools* [1]. These questions can be related to problem solving, communication, reasoning, connections, or representations. Having these questions available allows us to focus on one specific math goal for our class. For example, if one class is struggling to make connections from one math topic to another, the teacher could concentrate on using those guiding questions during math time for the next few weeks to address this need. This can be even more individualized by giving specific questions to workshop groups or individual students. We feel this process allows us to address the particular weaknesses within our classes without changing the mathematical content.

Our team collaboration, the restructuring of our students, and the components of our lessons have made teaching mathematics much easier and enjoyable for each of us. We see our students making connections and thinking at a deeper level. Our amazement continues as we teach our math lessons and hear our students using math talk to explain their answers. “So I guess we can talk during math class, but it has to be about math,” said one of our students. “Darn, I had a whole story I wanted to share about my favorite vacation.”

“Yes, dear, it does have to be about math.”

Reference

[1] *Mathematics Standards of Learning for Virginia Public Schools*, Board of Education, Commonwealth of Virginia, Richmond, VA, 2009.

APPENDIX A

*Below is an example of students using multiple strategies to solve the same problem. Each child **explained** how they figured out the answer and shared that with the class.*