

# Algebra Becomes Relevant in Classrooms



Pictured are Overland Trail Middle School teachers (from left to right) Marsha Aden, Feike Mooiman, Marcel Martin.

## Connecting Algebra

When will “the” asteroid hit the earth? Seventh-grade students at Overland Trail Middle School are learning to use mathematics to solve problems in science that seem exciting and relevant to them. Marsha Aden and Marcel Martin, 7th grade science teachers are working together to connect algebra to science. They are currently constructing science lessons requiring students to collect and analyze data.

As part of the astronomy (physics) unit, they include an experiment related to the concept of proportion in algebraic formula and the study of gravity. As mass increases, gravity increases. As distance increases, gravity decreases. Students collect data on the rate of descent at different altitudes. Students are given a problem of determining when an asteroid will hit the earth. They use an

acceleration equation.  $2D$  (distance) over  $T$  (time) squared. Then they use the data in an algebraic formula to predict when “the” asteroid will hit the earth.

Ms. Martin found an occasional application of mathematics in teaching social studies. One student assignment required her students to collect data on the rate of the spread of the Black Plague using dice as part of a social studies unit.

## Content Courses

Ms. Aden, Ms. Martin and an their 7th grade mathematics teacher colleague, Feika Mooiman (all pictured above) are among the twenty-two member cohort in a University of Colorado at Denver (UCD) Professional Studies course titled *Algebraic Patterns and Functions I*. This is one of the eight mathematics and eight science courses for teachers provided through the *Rocky Mountain Middle School Mathematics and*

*Science Partnership* (RM MSMSP) and funded by a National Science Foundation grant.

The purpose of each content course is to extend participating teachers' content knowledge and model pedagogy that may be duplicated or adapted slightly for use in the teachers' classrooms. Courses are taught collaboratively by university faculty and district science or mathematics instructional experts. (In addition to the content courses, a "structured follow-up {SFU}" course is scheduled during a subsequent semester during which teachers develop an innovation for their classrooms, present it, and receive extensive feedback for its refinement for use in their classrooms.)

### **RM MSMSP Grant**

The purpose of this five-year research grant is to study the impact of this model on science and mathematics instruction and student learning in grant-partner districts. Middle school student learning and middle school teacher professional development are the focus of this initiative.

### **Teachers' Response**

Feike Mooiman teaches four sections of 7th grade mathematics at Overland Trail Middle School. He reports that the *Algebraic Patterns and Functions I* course has provided him with a model of how to teach the content that is "superior to my previous knowledge." He admits that "when I was learning the algebra content as a high school student in the Netherlands, I didn't pay attention to pedagogy." "We went through the content very quickly." "Now I am in a Teacher-in-Residence program" to learn knowledge and skills related to teaching. The RM MSMSP courses show me instruction that is directly related to the content and level of student for my teaching assignment.

Marsha Aden, 7th grade science teacher, reported that she had not taken a mathematics course in 15 years. She was surprised that the content course worked as well for her as it did for those teachers who had stronger backgrounds in mathematics.

She attributes this experience to excellent instructors and the support of colleagues in the class. "It makes me a better teacher." "The course has taught me HOW to teach algebra to students and is a refresher for us on the content. The course instructors don't just talk about how to teach the algebraic concepts; they model it."

Marcel Martin is a social studies teacher with a degree in science but little previous experience or comfort in teaching science. The *Algebraic Patterns and Functions* course has "given me a view of what other teachers are doing and a content refresher as I transitioned into teaching three sections of 7th grade science." "I am on a three member team and now teach both science and social studies."

The funding of the RM MSMSP courses has made it possible for teachers in partner districts to take several courses. As an example, Mr. Moinam has completed *History of Mathematics, Calculus, Math Modeling*, and now *Algebraic Patterns and Functions*.

### **Impact on Instruction**

Mr. Mooiman stated that specifically, *Algebraic Patterns and Functions* has changed the way he teaches linear functions. Teachers in the course use graphing and the graphing calculator to complete learning activities that apply mathematics to solving relevant problems as opposed to limiting instruction to the concept or theory. As a result, he can use the same instructional activities to help his students gain a better understanding of the meaning of linear functions and the relationship of the functions. The graphing calculator is used to help student visualize what the functions look like. Instead of hand-drawing a single function, the graphing calculator can rapidly "graph" five functions at once.

Mr. Moinam says, "our students can do more experiments related to data collection activity and apply mathematics to the experiments. It is very nice for kids to understand that math is more than just

numbers. The experiments help students understand the relationship of mathematics to real work.”

### Teacher Collaboration

Four teachers from Overland Trail Middle School are taking Algebraic Patterns and Functions. An added convenience is that this course is being taught in our building. We work together to complete our own homework for the content course. Derrick \_\_\_, the 8th grade mathematics teacher and Mr. Mooiman have more conversations about the connections between their courses. Ms. Aden and Mr. Mooiman are communicating more about the potential connections they can make between 7th grade mathematics & science.

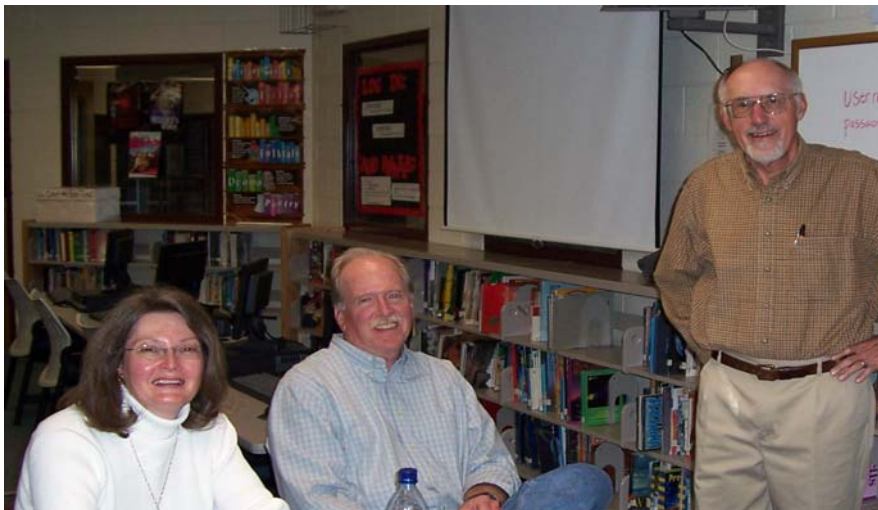
Each of three Overland Trail Middle School teachers felt that they gained a great deal from the professional communication among teachers from other districts who are assigned the same courses and sometimes teach the same units with the same content standards.

*The relevance of the content in the RM MSMSP courses make it take much less time to move the new instruction into my classroom for my students.*

Marsha Aden

### Teachers Model as a Student

“I tell my mathematics students that the courses require expectations of me in the same way that I have expectations of them as students. I showed my students an example of an assignment that I got and the feedback that I got from my instructors and colleagues. Even though my students didn’t relate to the content, they understood that I had to show my work and get feedback in the same way that I expect them to show their work and gain feedback from me and their fellow students.” (Mooiman)



Pictured are RM MSMSP instructors for *Algebraic Patterns and Functions* (Fall 2006) Jonna Bunting, Bruce MacMillan, and Dennis Shepherd.

*The teachers bring me incredible satisfaction because they are excited about the practical applications I invested time in developing, and they want to apply them immediately in their classrooms.*

Bruce MacMillan

Bruce MacMillan, University of Colorado Denver mathematics instructor, developed

the *Algebraic Patterns and Functions* in summer 2005 and has been an instructor for

each session. During the summer 2006, he taught the course with Gayle Bush, a retired mathematics teacher, and Julie Nieto, Jefferson County Coordinator of Mathematics. Each member of the instructional team brought a dimension that enriched the course.

During the fall 2006 session Bruce MacMillan taught the course with Jonna Bunting and Dennis Shepherd (pictured). The course content and organization changes with each session as new learning activities are developed that show students practical applications using mathematics.

*Algebraic Patterns and Functions* is now separated into a level I and level II. Level II includes topics for pre-calculus.

### **Topics**

The topics included in *Algebraic Patterns and Functions I* are ones typically included in a first year student algebra course.

- Linear Equations
- Linear Functions
- Quadratic Functions
- Exponential Functions
- Higher Order Polynomials and Functions
- Square Root Functions

### **Teacher Range of Background**

Mr. MacMillan stated that he “knew that the course would work for teachers with a range of experience because I had worked with Texas Instruments to show teachers how to use the graphing calculator in classrooms. My emphasis was on the activities to which the graphing calculator as a tool could be applied.”

Teachers in the course also have a wide variety of pedagogical styles. They share their seriousness in extending their own education. The grant-funded courses have made it possible for many of them to take courses that are immediately applicable to their own classrooms.

### **Instructor Observations**

The support of the university partners in the grant has been excellent. The University of

Colorado Denver is a research-based institution; however, Mike Jacobsen, Chairman of the Mathematics Department at the University of Colorado Denver, has been heavily involved in and supportive of mathematics education.

“The participating teachers bring me incredible satisfaction because they are excited about the practical applications that I invested time in developing, and they want to apply them immediately in their classrooms.”  
(MacMillan)