

## CHARACTERISTICS OF TWO OUTSTANDING ELEMENTARY TEACHERS OF MATHEMATICS: IMPLICATIONS FOR TEACHER EDUCATION

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*This study identifies characteristics of two “outstanding” elementary teachers of mathematics who were different in style and who taught in different settings. The intent is to determine what characteristics make these different teachers outstanding in hopes of helping preservice teachers improve their teaching of mathematics. Preliminary findings indicate that both teachers were (1) focused on children’s learning of mathematics; (2) focused on the mathematical solution methods used by students; (3) believed that all of their students could learn mathematics; (4) were enthusiastic and dedicated to the profession of teaching; and (5) cared deeply about their students and emphasized the necessity of building relationships with them.*

**Keywords:** Instructional Activities and Practices, Algebra and Algebraic Thinking, Elementary School Education, Professional Development, Preservice Teacher Education

Two teachers in the Conceptual Algebra Readiness for Everyone (CARE) Project for students in grades 3 to 8 distinguished themselves as “outstanding” elementary teachers of mathematics. Each teacher had different styles of teaching and they taught in different classroom settings. Both of the teachers in this study had CARE training, became CARE workshop trainers, and presented project work at national conferences. CARE is a curriculum development project for grades 3 to 8 in partnership with a high-needs school corporation (Feikes, Pratt, & Griffiths, 2012). CARE includes professional development for teachers around helping students develop conceptual algebra readiness and curriculum use. In interviews, both teachers described how CARE shaped their views of teaching mathematics. The goal of this study is to explore commonalities and differences in characteristics of these two teachers and discuss implications for teacher education.

### Methodology

This study employs a multiple-case study design (Baxter & Jack, 2008; Merriam, 2009) with a thematic analysis approach. In our analysis, we identified emerging themes which we understood to be “an extended phrase or sentence that identifies what a unit of data is about and/or what it means” (Saldaña, 2013, p. 175). Correspondingly, we grouped quotes from the interview transcripts to identify similarities, differences, and themes. The voices of the teachers are used to add understanding to outstanding teaching of mathematics. The two teachers were recruited to participate based on their work with CARE. They participated in structured interviews about their teaching practice and the recordings were transcribed. Additionally, the teachers were observed multiple times and one or two observed lessons were video-taped. This paper reports the analysis of the interviews, using the observations to support the analysis.

### Theoretical Framework

A review of studies that deal with excellence in teaching mathematics helped identify some characteristics of outstanding teachers (Hinz, Walker, & Witter, 2019; Lim, Tang, & Tan, 2013). One of these characteristics is building rapport with students and making strong connections.

Building rapport and making connections includes caring about students and the students recognizing that the teacher cares. A second characteristic is focusing on conceptual understanding while recognizing the importance of procedural knowledge. Additional characteristics noted in the research included demonstrating enthusiasm, showing respect for students, being prepared for instruction, and striving to be a better teacher. The literature review produced few current studies that focus on outstanding teaching of mathematics in the elementary school. A key premise of this paper is interpreting what has been learned by these two elementary teachers to help preservice teacher education.

### **Commonalities and Differences in Characteristics**

The first teacher, Mr. Francis (pseudonym), taught for forty years in a Midwestern city with a population of 20,000. A majority of his teaching was in fourth grade. Mr. Francis taught in the school with the highest state standardized test scores in the district. The students in the school were predominantly middle class and White. The school had a 12% minority population and a free and reduced lunch rate of 24%. In recognition of his excellent teaching, Mr. Francis was the winner of the Presidential Awards for Excellence in Mathematics and Science Teaching.

The second teacher, Mr. Marker (pseudonym), taught in a Midwestern city with a population of 40,000. Mr. Marker taught several different primary grade-levels over fifteen years, most recently sixth grade. The school where he taught had a 55% minority population and a free and reduced lunch rate of 76%. Mr. Marker was also recognized as an excellent teacher as a finalist for the Presidential Awards for Excellence in Mathematics and Science Teaching.

Observations and interviews found that the teaching styles and personalities differed for each teacher. Mr. Francis was a composed and caring teacher, describing one of his classroom interactions as "... without being angry or loud." His students never misbehaved. Mr. Francis was very organized, as demonstrated by his calendar of academic standards to be addressed for the entire year. Mr. Marker was higher-energy and sarcastic. The students enjoyed their relationships with Mr. Marker, as evidenced by the number of students who came up to him before school to joke around and share stories. Observed math lessons were energetic and nonstop. Despite the high number of students that lived in poverty, Mr. Marker's sixth-grade students demonstrated success on the state standardized mathematics test, with all but one student earning a passing score.

Differences between the teachers help put their commonalities in starker contrast. Mr. Francis was a planner. When comparing himself to other teachers he noted, "I spend more time planning and creating my own curriculum, making sure I have all the standards outlined." In contrast, when Mr. Marker was asked to compare his planning to Mr. Francis he said, "I go more spontaneously in the classroom." Another difference between the two teachers was their level of confidence about their own mathematical ability. Mr. Francis described a lack of confidence in his mathematical ability. "By the time I got to high school I was not confident. ... I did not feel like I was a great math student." His lack of confidence motivated him to make mathematics more meaningful for his students. In contrast, Mr. Marker was very confident in his mathematical ability. Referring to his high school math classes, he said, "At the time it was being taught, I could go the process of it and do the work fine."

Despite these differences, analysis of the interviews found characteristics that the teachers had in common. The first characteristic described by the teachers during the interviews was focusing on children's learning of mathematics. When asked what aspects of mathematics were personally interesting, Mr. Francis talked about children's learning. "It is interesting to see how

children think and to see how they solve certain problems and to see how they develop from one stage to another in certain areas.” When asked the same question, Mr. Marker also talked about children’s learning of mathematics.

It is trying to get kids to be problem solvers. It’s the most challenging because it is so broad. You can find 5 or 6 approaches to solve any problem using computational strategies. ... They do it a different way because they are smart enough, because they have built the skills.

In the mathematics education community, we categorize all the different types of mathematical and pedagogical knowledge, but these teachers did not make that distinction in the interviews. For them the interesting aspect of “mathematics” was how children learn mathematics.

The second common characteristic was that each teacher focused on the solution methods used by students when working on mathematics problems. During the interviews, both teachers mentioned that they encouraged the students to share a variety of solution methods. Mr. Francis said, “You wouldn’t think it would be so diverse, to see the different types of thinking going on.” He relished the enthusiasm students had when they explained their ways of thinking and noted that they especially enjoyed describing different ways to think about a problem. Mr. Marker said, “Some of the coolest moments in the classroom are when kids show different ways that they figured it out and they can’t wait to express it. They do not want to be like anyone else.”

The third common characteristic was the belief that all students could learn mathematics at a meaningful level. Mr. Marker regularly commented that all his high-poverty students could be successful in mathematics. Mr. Francis expressed similar sentiments about his middle-class students. Both teachers commented on the importance of the solution process and on the value of enabling students to develop their own mathematical thinking.

The fourth common characteristic from the interviews was that each teacher was enthusiastic and dedicated to the profession of teaching. Mr. Francis said “I love it when you see students getting something and you see them excited.” Mr. Francis built his enthusiasm off of children’s excitement of learning. Mr. Marker was also enthusiastic about teaching, he said, “I really care about [teaching]. I care about the kids being successful, I love to teach. I get excited about it every day, like every day is a fun day for me.” These comments demonstrate their enthusiasm for and dedication to teaching.

The interviews and observations provided evidence of a fifth characteristic shared by the teachers; both teachers cared deeply about their students and emphasized the necessity of building relationships with them. This finding is consistent with prior research (Lim, Tang, & Tan, 2013). For example, Mr. Marker stated:

Once you are able to build that relationship with the kids, once they know that you care about them and they can trust you, they will do anything for you in the classroom. ... I think the kids have a good respect for us and we do for them. And that goes a long way in how you manage your classroom and build relationships with students.

When asked what made him an outstanding teacher Mr. Francis referred to his organizational ability and his relationship with children. “I think with the planning and wanting to know the whole child and caring about them and wanting to know their whole picture.”

### Discussion

The analysis of the data demonstrated that these outstanding teachers of mathematics focused on children’s mathematical learning, focused on students’ solution methods, believed that all of

their students could learn mathematics, were enthusiastic and dedicated to the profession of teaching, and cared deeply about their students and emphasized the necessity of building relationships with them. These findings have implications for mathematics teacher education.

Research has shown that preservice teachers benefit from learning how students learn about mathematics (Feikes, Pratt, & Hough, 2006; Philipp, Thanheiser, & Clement, 2002). In preservice teacher education, we can emphasize the value of knowing children's thinking and focusing on children's solution methods to develop conceptual understanding and assessment. Both mathematical content and methods of teaching in the education of preservice teachers should foster a focus on students' learning of mathematics.

In order to help preservice teachers focus on solution processes or take an inquiry approach in their teaching (Richardson & Liang, 2008), similar approaches should be modeled in college courses. Field experiences that focus on the process and not the product should be available for prospective teachers. Experiencing a focus on process in their college courses and in the field will help preservice teachers adopt this approach to teaching mathematics.

Mr. Francis supported students who were two or three grade levels behind. Mr. Marker taught in a high poverty school and in one year, 55 out of 56 students passed the state accountability test in mathematics. A point to emphasize with preservice teachers is that teachers can make a difference when their teaching embodies the idea that all students can learn mathematics.

As professionals participating in ongoing teacher education, these two teachers regularly participate in professional development. They were interested in what other teachers do and often tried to adapt their teaching based on conversations with other teachers. Preservice teacher education should encourage this type of professional collegiality. Similarly, instructors of preservice teachers need to model enthusiasm for the teaching profession and provide field experiences where prospective teachers see this in action.

Both teachers in this study described developing positive teacher-student relationships with their students. These relationships added to the learning of mathematics and promoted a safe learning environment. Preservice teachers need to learn about developing teacher-student relationships with students based on respect so that the students know they care about them.

### Conclusion

This paper describes commonalities and differences in characteristics of two outstanding teachers of elementary mathematics. The teachers taught in different instructional settings, one was a planner and one was not, and one was very confident in his math abilities and the other had significant reservations. However, both teachers focused on children's learning, the solution methods used by students, and all students being able to learn mathematics. Both teachers were enthusiastic about being teachers and dedicated to professional growth. They cared deeply about their students and building relationships with them. These characteristics have implications for higher education teacher education programs. Preservice teachers need experiences that help them consider student solution methods and student learning about mathematics. Teacher education programs should provide opportunities for collegial interactions around mathematics education and building enthusiasm for mathematics teaching.

Because the characteristics identified in this research are limited to the case study of two teachers, there are limitations to these findings. Interviewing additional outstanding teachers of mathematics and comparing findings to existing research (e.g., Hinz, Walker, & Witter, 2019) could provide additional insights, especially for the teaching of mathematics in the elementary

school. Identifying key characteristics and incorporating them into teacher education programs can help advance the effectiveness of future teachers of mathematics. Additional research on how these characteristics can positively impact mathematics teacher education is also needed.

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