

Primarily Math

Impacting Math Achievement of K-3 Teachers and Students



Primarily Math is a 13-month graduate program for primary grade teachers who accept the challenge to return to graduate school to study mathematics and the teaching of mathematics.

University of Nebraska–Lincoln (UNL) faculty and graduate students have shown through their research that Primarily Math can significantly impact the achievement of young children, particularly those who start the year below grade level. Primarily Math began as one component of NebraskaMATH, a Math Science Partnership grant from the National Science Foundation (NSF).

Nebraska
MATH

The goal of Primarily Math is to improve equitable mathematics teaching and learning by strengthening kindergarten to third-grade teachers' mathematical and pedagogical knowledge for teaching and their professional interactions with other teachers in their schools, while improving attitudes toward the teaching and learning of mathematics. Teachers earn a K-3 Mathematics Specialist Certificate from UNL upon completion of the 18-credit-hour graduate program.

More than 500 teachers have completed the program since 2009. During the period of NSF funding, Primarily Math was developed, studied, evaluated and regularly improved, thus offering Nebraska school districts a proven, effective and equity-oriented professional development program. Nebraska districts, in particular in Educational Service Unit 3 and the Lincoln Public Schools, have responded in many ways to finance opportunities for their teachers to participate in this outstanding program. Grants from The Sherwood Foundation®, the Lozier Foundation, Women Investing in Nebraska and the U.S. Department of Education have allowed teachers across the state to participate. <https://scimath.unl.edu/primarilymath>



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To discuss starting a cohort of Primarily Math in your district or ESU, please contact:

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N CENTER FOR SCIENCE, MATHEMATICS AND COMPUTER EDUCATION



Primarily Math Research

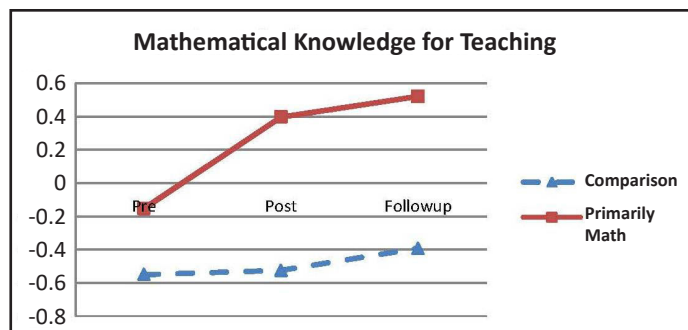


NSF and OPS Teacher Leader Academy Primarily Math teachers took three annual surveys in order for us to measure the impact of Primarily Math on teachers' mathematical knowledge for teaching, attitudes toward mathematics and beliefs about mathematics, teaching and students.

Teacher Knowledge of Mathematics Increases

Our courses focus on helping teachers improve their Mathematical Knowledge for Teaching. Mathematical Knowledge for Teaching (MKT) includes anticipating student misconceptions and errors, planning examples, using manipulatives, connecting different representations, understanding how algorithms work, and connecting different mathematical concepts. A survey of MKT, developed at the University of Michigan for K-6 teachers, measures this type of knowledge.

The survey is designed for K-6 teachers. Thus, we were not surprised to find that the K-3 teachers, even the outstanding teachers we were recruiting, initially performed somewhat below the national norm group of K-6 (scaled score of 0). Indeed, both Primarily Math (PM) teachers before PM and the comparison group teachers did initially score below the national average for K-6 teachers. However, **at the end of PM and in the years following, our K-3 teachers scored well above the national average.** Average growth of PM teachers' MKT from beginning to end was .67 standard deviations (considered a large gain); comparison group teachers remained statistically flat.



Confidence Grows, Anxiety Decreases for Teacher Attitudes and Beliefs

In addition to the measure of mathematical knowledge for teaching, teachers also take a Mathematics Attitude Inventory for Teachers and a Survey of Teaching Practices, which includes items about beliefs about mathematics, teaching, learning, and students. Over time, **PM teachers experienced more confidence and increased student-centered beliefs, along with less anxiety and decreased teacher-centered beliefs.** During this time, the comparison group scores remained statistically flat. In particular, we know that female teachers' mathematical anxiety is "contagious" for girls, so decreasing teacher mathematical anxiety is a very positive outcome.

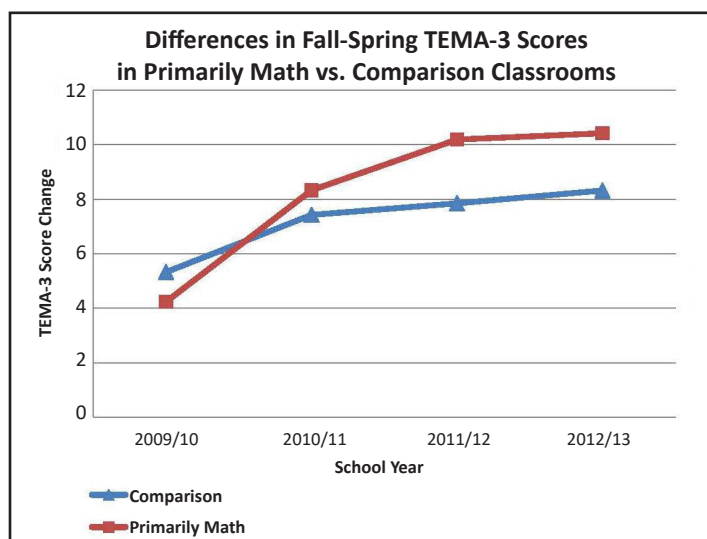
Social Network for K-3 Teachers Expands

In a study conducted in three large districts, in collaboration with colleagues at Northwestern University, we used a Teacher Network Survey in 2010, 2011 and 2013 to learn more about those from whom teachers seek advice regarding teaching mathematics, as well as those who seek their advice. Often, the presence of a PM teacher leads to changes in how often teachers talk about math with others and whether teachers view PM teachers as a resource for advice about mathematics teaching and learning. More: scimath.unl.edu/primarilymath/impact

Student Achievement Increases

We administered the TEMA-3 (**Test of Early Mathematics Ability**, 3rd Edition), an individually administered test for children up to age 9 that measures their number and operations procedural and conceptual understanding, to approximately 1,500 students per year in Lincoln, Omaha, and Papillion-La Vista during the NSF grant. We expected student achievement gains would show up beginning in the years after a teacher has completed PM. By the project's third and fourth years, students in classes of PM teachers had statistically significantly larger gains from fall to spring on the TEMA-3, compared to students in the comparison classrooms.

"Students in classes of Primarily Math teachers who started off below grade level had the biggest gains, therefore we found that Primarily Math helped narrow equity gaps in student achievement data," said Dr. Wendy Smith, director of the Center for Science, Mathematics, and Computer Education.



Program Costs

The tables below show the estimated costs of holding a cohort of Primarily Math if districts/ESUs assume the whole cost (left) or partial costs (right). The cost tables represent two of many possible ways districts and/or ESUs could subsidize teacher costs. With no district support, the cost per course per teacher is typically \$1,250, for a total of \$7,500 (20% of a relatively new teacher's annual salary) for tuition and fees for six courses before fellowships from UNL.

Full District Support			Partial District Support		
Cost for 15 Teachers		Comments	District Pays	Teacher Pays	Comments
Tuition	\$82,962.00	6 courses (with summer tuition discount and NMSSI fellowships for four courses)	\$41,481.00	\$2,765.40	District pays half tuition
Fees	\$17,419.00	Courses held via web conferencing or online	\$0.00	\$1,161.27	Teacher pays full amount
Master Teacher	\$10,800.00	Assistant instructor from the K-12 district	\$10,800.00	\$0.00	District pays full amount
Total	\$111,181.00	for 15 teachers	\$52,281.00	\$3,926.67	

Full District Support			Partial District Support		
Cost for 25 Teachers		Comments	District Pays	Teacher Pays	Comments
Tuition	\$138,270.00	6 courses (with summer tuition discount and NMSSI fellowships for four courses)	\$69,135.00	\$2,765.40	District pays half tuition
Fees	\$29,031.50	Courses held via web conferencing or online	\$14,515.75	\$580.63	Teacher pays half of the fees
Master Teacher	\$8,100.00	Assistant instructor from the K-12 district	\$8,100.00	\$0.00	District pays 75% of full amount
Total	\$175,401.50	for 25 teachers	\$91,750.75	\$3,346.03	

Primarily Math Academic Program

Participating teachers take three mathematics courses and three education courses from UNL to earn 18 graduate credit hours and a K-3 Math Specialist Certificate from the Board of Regents. This program is not a certification for your state license or an endorsement. Participants start in the summer and end the following summer. Summer courses meet synchronously via web conferencing or can be arranged in-person. Fall and spring courses are online.

Term	Course Length	Course Title
Summer 1	1.5 weeks	MATH 800P: Number and Operation (offered in even years)
Summer 1	1.5 weeks	MATH 801P: Geometry, Measurement & Algebraic Thinking (even years)
Fall 1	15 weeks	TEAC 836G: Professional Development: Mathematics Leadership (even years)
Spring 1	15 weeks	TEAC 807C: Equitable Practices in Mathematics Education: Classroom Discourse (odd years)
Summer 2	2 weeks, half days	MATH 802P: Number, Geometry & Algebraic Thinking II (odd years)
Summer 2	2 weeks, half days	Three options, choose one: (odd years) 1) TEAC 808G: Improvement of Instruction in School Mathematics: Manipulatives 2) TEAC 848G: Mathematics Curriculum Analysis and Design 3) TEAC 807A: Equitable Practices in Mathematics Education: Identity, Access, and Equity

Benefits of Primarily Math



Focusing on the process and not just on the end result is the foundation on which Primarily Math is built. Teachers delve into gaining a deeper understanding of their mathematical and pedagogical knowledge for teaching and further examine their attitudes and beliefs about mathematics. For nearly all participants, the experience positively impacts their teaching and causes them to think differently about mathematics instruction.

“Although our math curriculum is scripted, I now understand how to incorporate many other instructional strategies into my lessons, such as math talk,” said Judy Stukenholtz, a kindergarten teacher at Wahoo Elementary. “The strategies that I learned while taking Primarily Math have definitely strengthened my confidence in knowing math and teaching math. It also gave me ways to encourage my team to teach math in different ways.”

Strategies learned through the program lead directly to inspiring teachers to make changes in their classrooms.

“When I first started teaching, I felt pulled to teach in a way that was product-based, and I lacked the deeper mathematical understanding that I wanted for my students,” said Jennifer Jones, now a kindergarten teacher at Harvest Hills Elementary. “After Primarily Math, my math lessons now focus on the process, not necessarily the product. My students’ understanding of the ‘how’ and the ‘why’ have become so much more important to them, not only in their mathematical learning, but also in their learning in general.”

With 40 hours of instruction in three weeks or fewer, Primarily Math can be an intense summer experience. However, teachers consistently report that the program is rewarding and worth the effort.

“While they were the most challenging graduate-level classes I have ever taken, it was worth every bit of the struggle. It will change how you think, teach, and present mathematical learning to both students and adults,” said Jones, who has been teaching at Gretna Public Schools since 2010 and was a second-grade teacher at Gretna Elementary during the Primarily Math program.

Veteran teacher Stukenholtz said her peers asked why she was doing Primarily Math when she probably didn’t need to, after teaching for 20 years in public school and 20 years in a preschool. The Gordon, Nebraska, native found that she *did* need to.



(Top) Judy Stukenholtz, Wahoo Public Schools; (Left) Jennifer Jones, Gretna Public Schools

“If you want to build your self-worth and be proud of what you do every day, you need to grow and learn every day.”

– Judy Stukenholtz

“It inspired me to be a better teacher, not only in math, but in everything else that I do,” Stukenholtz said. “If you want to build your self-worth and be proud of what you do every day, you need to grow and learn every day. That’s why all primary grade teachers should participate in Primarily Math.”

Even in a kindergarten classroom, Stukenholtz said she could apply what she learned from Primarily Math every day. “The math talk and understanding number-ness has been so much fun to use with my students. After re-learning about trajectories and building number sense, I think about how I can do that in every lesson,” Stukenholtz said.

Jones’s favorite part of the program was working closely with a cohort and learning how teachers can approach mathematics in different ways and with different insights.

“A favorite part of Primarily Math for me was the relationships with the other ‘students’ in my cohort, as well as the instructors that we had,” Stukenholtz said. “I also loved being able to take these strategies and watch my students flourish from them. Amazing!”

A Message from CSMCE Director Dr. Wendy Smith:

We all want all of our students to be successful in life. Mastering the foundation of K-3 mathematics is crucial to students having access to STEM careers. Elementary mathematics is more than just arithmetic, it encompasses ways of thinking that see patterns, understand the structure of mathematics, and communicate reasoning. Students excel when they have teachers who embrace the habits of mind of mathematical thinkers and are equipped with the pedagogical and mathematical skills to help each student learn. We know education remains impacted by the COVID-19 pandemic; it is more important than ever that teachers develop skills to combat mathematics anxiety, their own and their students', and help students feel successful at learning mathematics.

Building a Community



Networks started during Primarily Math continue today, and teachers' confidence with mathematics grows.

For Papillion-La Vista kindergarten teacher Michaela Overby, Primarily Math provides her with a "math community" that not only builds on the collaborative nature of her school and district but also extends beyond those relationships. "The goal for teachers is to always be better. If your kids are already doing well, then the question becomes, 'what can we do to help them have even more success?'" Overby said.

Experiencing "productive struggle" herself in Primarily Math courses has changed how third-grade teacher Heather Kramer of Lincoln Public Schools leads her classroom at Rousseau Elementary.

"Not only do I feel more confident as a math teacher, but I am more comfortable giving students the time needed to explore math without feeling like I need to step in and correct their work," said Kramer, who has been teaching for 20 years. "I am more confident in the classroom, teaching a growth mindset. Students get time to explore activities with their background knowledge and work with others to learn alternate strategies."

Kramer, who graduated from UNL in elementary education, approaches math in an inquiry style, listening and asking questions to deepen her students' approaches.

"The camaraderie of Primarily Math was my favorite aspect," Kramer said. "It is refreshing to work with like-minded people who value the art of inquiry in mathematics. I have built relationships with many of the participants and continue to keep in contact with them."

Kramer was also a math liaison for her building for four years, working with administrators to help educators



Michaela Overby, G. Stanley Hall Elementary, Papillion-La Vista

understand the importance of common language and collaboration among multiple grade levels.

The ability to immediately implement what she learned from Primarily Math into her classroom gave Overby

newfound confidence in teaching math. After the first summer, she began thinking about the vocabulary she uses and stopped teaching her students "rules that expire." She also began using bar diagrams to teach story problems.

Overby, who also graduated from UNL, with majors in elementary education and psychology, said this program is the best professional choice she has made: "The change Primarily Math has made in myself as

a mathematician, a learner of math, and a teacher of math truly can't be put into words. It was the best thing I have done for myself as a teacher and my students."



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“The Primarily Math program has helped me to be a strong instructional leader, specifically in mathematics. Primarily Math helped to strengthen a growth mindset within myself and as I lead staff and teach students. We can do hard things!”

– **Leah Kastrup, principal, Conestoga Elementary, Omaha Public Schools, and Primarily Math graduate (former third-grade teacher)**

“It helped me better understand ways to teach young children how to conceptually learn math and how to talk about what they are learning. The focus is on the productive struggle to get to the answer and to know the steps and progression in that learning process.”

– **Becky Unterseher, principal, Pyrtle Elementary, Lincoln Public Schools, and Primarily Math graduate (former fourth-grade teacher)**



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