



**Content Academies for
Teaching K-8 Mathematics**

“For three consecutive summers, we partnered with Carnegie Learning to provide week-long content academies to 220 teachers in kindergarten through eighth grade. Our data show that this work not only dramatically increased their content knowledge, it positively changed the way they feel about the teaching of mathematics. Our teachers talk about going from a rote understanding of procedures to a deepened understanding of concepts and from a teacher-centered delivery with worksheets to a student-centered learning environment in which students are engaged in ‘talking’ the math and discovering multiple pathways to the learning. Thank you Carnegie for helping us impact these 220 teachers and thereby thousands of students in our region.”

- Liz Storey
Executive Director
Green River Regional
Education Cooperative

“At the inception of the K-8 Math Alliance, we began reviewing available materials and professional development options for increasing the mathematical content knowledge of the participants in algebraic thinking through the experience of being a learner. We wanted to seize the opportunity to not only stretch mathematical knowledge but to model what a quality lesson is like in practice. The lessons in the Carnegie Learning instructional materials were a foundational component in the content academies. Each lesson included clear and defined standards, critical vocabulary, essential questions, multiple representations, and problem solving tasks which required a higher cognitive demand from learners and fostered mathematical discussion.”

- Sandra Baker
Math Alliance Coordinator
Green River Regional
Education Cooperative

Building Teacher Capacity

Building teacher capacity to instruct in mathematics is a highly visible recommendation from the 2008 National Mathematics Advisory Panel. The final report states, “that teachers be given ample opportunities to learn mathematics for teaching. That is, teachers must know in detail and from a more advanced perspective the mathematical content they are responsible for teaching and the connections of that content to other important mathematics, both prior to and beyond the level they are assigned to teach.”

Carnegie Learning offers K-8 math content academies specifically designed to help address the following objectives:

- Strengthen K-8 teachers’ content knowledge in mathematics and
- Impact K-8 teachers’ beliefs and attitudes about teaching mathematics.

Content Academies for K-8 Teachers

The purpose of our content academies is to increase teachers’ understanding of mathematics. We achieve this objective by limiting lecture from a lectern and instead create a learning environment for teaching professionals where they discover, explore, reason, share and reflect.

Benefits

Fostering a Learning By Doing® environment is one of the hallmarks of our math content academies. The benefits of incorporating this principle into our workshop design, include:

- Participants are active learners in cohort groups;
- Activities relate to the realities of teaching in a K-8 classroom;
- Teachers’ attitudes about teaching mathematic are impacted;
- Workshops are designed for specific grade level bands (K-3, 4-5, 6-8); and
- Participants receive a Cognitive Tutor® software license to reinforce their mathematical knowledge.

Each content academy listed on the following page involves both classroom and lab work for teachers. The outcomes for the workshops include:

- Deepening teachers’ understanding of mathematics,
- Strengthening mathematical reasoning, and
- Enhancing attitudes, beliefs and classroom practices for teaching math.



Content Academy Workshop Title	Big Math Ideas Covered	Recommended Grade Bands	Workshop Length
Developing Mathematical Understanding	<ul style="list-style-type: none"> Analyzing mathematical tasks Meaning of fractions Fractional parts of region Fractions as parts of wholes Fractions as divisions Equivalent fractions Comparing and ordering fractions Divisions for whole numbers and fractions Comparing beyond subtraction: ratio, rate and proportional reasoning 	For teachers instructing in grades 4-5	5 days. Days 1 and 2 must be delivered consecutively. Days 3-5 can be scheduled flexibly.
Developing Algebraic Thinking	<ul style="list-style-type: none"> Analyzing mathematical tasks Multiple representations Comparing beyond subtraction: ratio, rate and proportional reasoning Multiple representations of linear functions Putting it all together: Compare and contrast linear, quadratic, and exponential functions 	For teachers instructing in grades 6-8	5 days. Days 1 and 2 must be delivered consecutively. Days 3-5 can be scheduled flexibly.
Early Fractions Concept	<ul style="list-style-type: none"> Analyzing mathematical tasks and creating fraction representations Comparing fraction representations and operating with fractions Working with ratios 	For teachers instructing in grades K-3	3 days. Days 1 and 2 must be delivered consecutively. Day 3 can be scheduled flexibly.
Number Properties and Integers	<ul style="list-style-type: none"> Analyzing mathematical tasks and whole number properties Powers, factors, integers Operations with integers 	For teachers instructing in grades K-3	3 days. Days 1 and 2 must be delivered consecutively. Day 3 can be scheduled flexibly.
Connecting Decimals and Percents to Fractions	<ul style="list-style-type: none"> Analyzing mathematical tasks and operations with decimals as special fractions Decimal operations and percents Algebra connection 	For teachers instructing in grades K-5	3 days. Days 1 and 2 must be delivered consecutively. Day 3 can be scheduled flexibly.
Proportional Reasoning and Linear Relationships	<ul style="list-style-type: none"> Proportional reasoning and writing equations Multiple representations of linear functions Data analysis 	For teachers instructing in grades 4-5	3 days. Days 1 and 2 must be delivered consecutively. Day 3 can be scheduled flexibly.



Funding Sources For Professional Development

There are a number of federal and local funding sources for professional development, including:

- Title I, Part A: Improving Basic Programs
- Title II, Part A: Teacher and Principal and Recruiting Fund Training
- Title II, Part B: Mathematics and Science Partnerships
- Title V, Part A: Innovative Programs
- Title V, Part B: Charter-School Programs
- 21st Century Community Learning Centers
- State and local funding sources

Please contact your Carnegie Learning Regional Account Manager to learn more information about our professional development workshops, pricing, and scheduling at (888)851-7094.

To learn more about the array of professional development offerings Carnegie Learning provides, please visit www.carnegielearning.com.

Testimonials

I never knew WHY we could invert and multiply. I now know and could explain it to students rather than just saying “because it’s a rule.”

**- Michelle Pruitt
Teacher
Auburn Elementary**

I now know better what students will be learning after they leave my classroom, so I can make them better life-long learners instead of just getting them ready for this year’s assessment.

**- Jason Dargo
Teacher
Rich Pond Elementary**

I am now more in tune with how my kids “think” about math. I want them to know the “why,” not just the procedure.

**- Shirley Beatty
Teacher
Caneyville Elementary**

Student achievement has been impacted because students are able to make stronger connections because I am teaching relationships, not just processes.

**- Marty White
Teacher
Chandler’s Elementary School**

Carnegie Learning Content Academies Increase Teacher Content Knowledge

The Green River Regional Education Cooperative (GRREC) is a service provider for 33 South Central Kentucky school districts, which totals more than 110,000 students and 15,000 teachers, administrators and other support personnel. This cooperative is committed to helping its member school districts expand and advance educational opportunities and standards for their students. They provide professional development opportunities for teachers and emphasize training as a crucial step in improving the value and efficiency of instruction that students receive.

GRREC approached Carnegie Learning with a problem about student achievement in mathematics. In order to improve student achievement, they wanted to improve the mathematical understanding of their K-8 teachers.

With the support of the Kentucky Department of Education, GRREC teamed up with Carnegie Learning in 2006. Over a 3-year period, over 220 teachers participated in week long math content academies.

Outstanding Results

Teachers were given a basic Algebra content assessment on the first day. At the end of the 3-year program, the teachers were given the same assessment again. Results showed that participants who attended the workshop all three years showed a significant increase in their algebra content knowledge. In addition, there was also a significant increase in positive attitudes towards the teaching of mathematics.

Summary of Mean Algebra Content Scores, 2006 and 2008

“The algebra content knowledge assessment contained 10 multiple-choice and 10 open-ended response questions. Participants completed this assessment in 2006 and 2008. Mean content scores increased for participants in all grade spans between 2006 and 2008.”

- University of Louisville
Center for Research in Mathematics and Science Teacher Development

Grade Span	2006		2008	
	<i>n</i>	<i>M</i>	<i>n</i>	<i>M</i>
K-1	39	5.62	48	13.02
K-2	39	7.85	56	14.77
K-3	40	13.02	58	21.76
K-4	35	18.71	36	27.75
K-5	153	10.21	198	18.75

In summary, the teachers who went through this three year program showed improvement in their math content knowledge and reported positive attitudes about teaching mathematics.

To request a copy of this study, please e-mail info@carnegielearning.com.



Frick Building
20th Floor
437 Grant Street
Pittsburgh, PA 15219

Toll Free: 888.851.7094
Local: 412.690.6284
Fax: 412.690.2444
info@carnegielearning.com
www.carnegielearning.com

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