RICE UNIVERSITY
SCHOOL MATHEMATICS PROJECT

Leveraging Technology
to
Enhance Mathematics Teaching and Learning

Early Education and Technology for Children Conference

Salt Lake City, Utah
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The Rice University School Mathematics Project's Program for K-12 Mathematics Teachers*

- served nearly sixty K-12 schools across nine school districts in 2009-10 and 2010-11
- provided four weeks each summer of intensive mathematics and pedagogical instruction (K-3, 4-6, Middle School, High School)
- provided academic-year follow-up

*partially funded by the Texas Higher Education Coordinating Board Teacher Quality Grants Program

The Rice University School Mathematics Project's Program for K-12 Mathematics Teachers

Teachers' Professionalism

- mathematics content knowledge
- pedagogical content knowledge (technology-rich)
- transfer of mathematics and pedagogical content knowledge into mathematics instructional practice
- self-efficacy
- collaborative planning and reflection on instruction

Master Teachers' Role

For each course, a team of two master teachers develop mathematics and pedagogical course content and compile resources to increase teachers' knowledge and improve teachers' instructional skills to support student learning.

Master Teachers' Role

Master teachers plan, facilitate, and model instructional best practices and utilize a curriculum that incorporates manipulatives and technology.

Five Classroom Features Impacted by Technologically-infused Instruction

- nature of instructional tasks
- teacher's role
- social culture
- mathematics tools to support learning
- accessibility and equity

Hiebert, J., Carpenter, T. P., Fennema, E., Fuson, K. C., Wearne, D., & Murray, H. (1997). *Making Sense: Teaching and Learning Mathematics with Understanding*. Portsmouth, NH: Heinemann.

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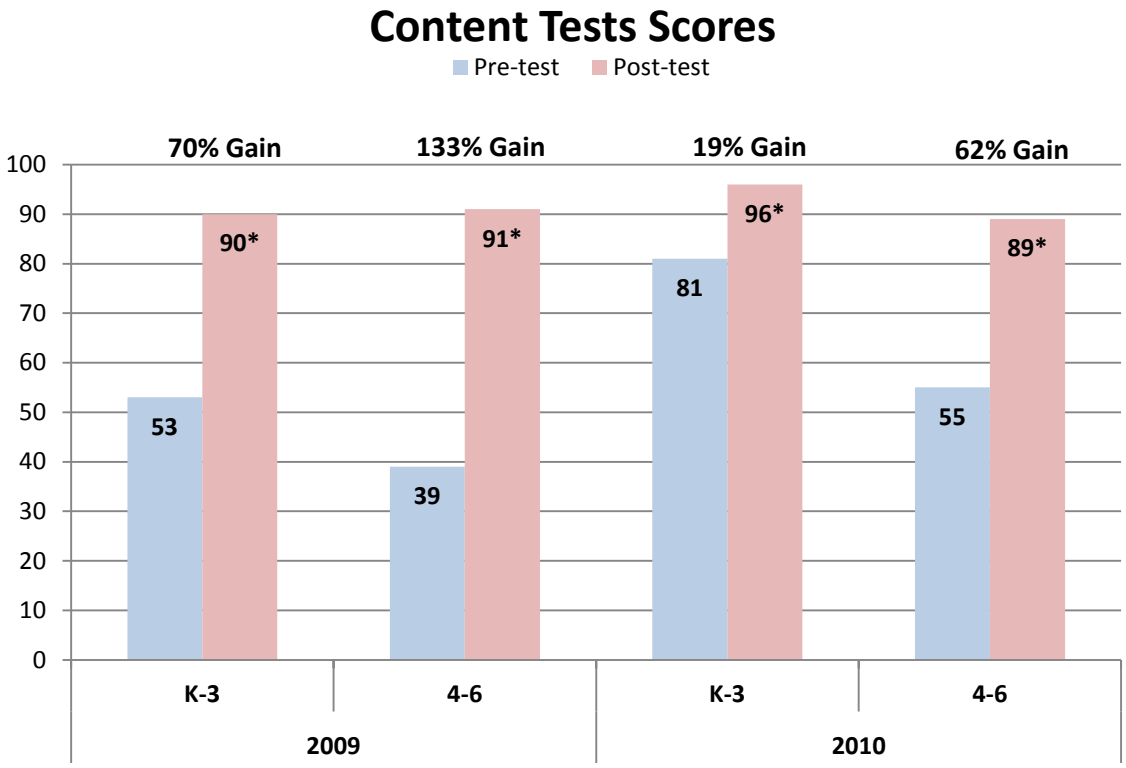

*p. <001

Mathematics Pedagogy
(Pre- and Post-Survey)

K-3 and 4-6 Class Gains: 2009-10 and 2010-11

- *Students need to master basic computational skills before they can engage effectively in mathematical problem-solving. [↓]
- *Teachers should not necessarily answer students' questions but should let them figure things out themselves. [↑]
- *The most important issue is NOT whether the answer to any math problem is correct, but whether students can explain their answers. [↑]
- *Students should write about how they solve math problems. [↑]

*Opportunity for infusion of technology

[↓ or ↑] Desired direction of change

Strong pedagogical content knowledge is necessary for effective classroom instruction.

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Mathematics Pedagogy
(Pre- and Post-Survey)

Additional Gains in K-3 Classes: 2009-10 and 2010-11

- *Teaching a math concept should begin with a concrete example or model.[↑]
- *For students to get better at math, they need to practice a lot. [↓]
- *If a student is confused in math, the teachers should go over the material again more slowly. [↓]

Additional Gains in 4-6 Classes: 2009-10 and 2010-11

- *When students can't solve problems, it's usually because they can't remember the right formula or rule. [↓]

*Opportunity for infusion of technology

[↓ or ↑] Desired direction of change

Strong pedagogical content knowledge is necessary for effective classroom instruction.

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Teachers' Quotes:

Self-efficacy and Technology

"Technology will be a daily integrated tool used during mathematics….I feel that I am now equipped with a wide assortment of website resources …. The virtual manipulative website modeled by our Master Teachers will definitely be used as an assignment during computer lab."

"Technology has made teaching become more manageable and organized…."

"Finally, technology in the classroom has always been an after-thought in my planning. After receiving technology and learning how to use it, I plan to utilize the laptop and small digital camcorder into my classroom. I know the children will greatly enjoy this."

(paraphrased)

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Teachers' Quotes:

Self-efficacy and Technology

"I learned about scanning pictures from books using my document camera. The ideas that all my classmates and teachers shared this summer have played an integral part in forming the foundation that I have for teaching 6th grade math this year.... focused on all the learning styles."

"I gained so much knowledge that I am gearing up to use for this new school year.... Technology will be the most exciting part of my lessons. I am … thinking of animations that I can put together with my flip camera to introduce a new topic. I am considering using my … netbook in a center for students to use software that I just got training in called Gizmos."

(paraphrased)

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Teachers' Quotes:

Self-efficacy and Technology

"We learned about glogster in class this summer. This is a great call because you can find many different website activities and put them altogether in one spot so it is easier for children to navigate. I plan on creating a glogster at least once a semester. They can be used to scaffold learning and for review. I also plan on going on a shape hunt in my neighborhood park with my flip camera and taking photos to add to my website for classroom discussions."

"I am planning to give small group projects so that students can use flip cameras, make videos, and share with the class."

"RUSMP has made me a very confident teacher…. I have plans for my students to use the cute Flip Camera and make small presentations on various objectives. My main goal is to make all the lessons student centered, challenging, interesting and make learning fun, so that students want to learn and learning becomes permanent."

(paraphrased)

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Teacher's Reflection on a Technology-infused Lesson

Objective: Kindergarten students identify and extend growing patterns.

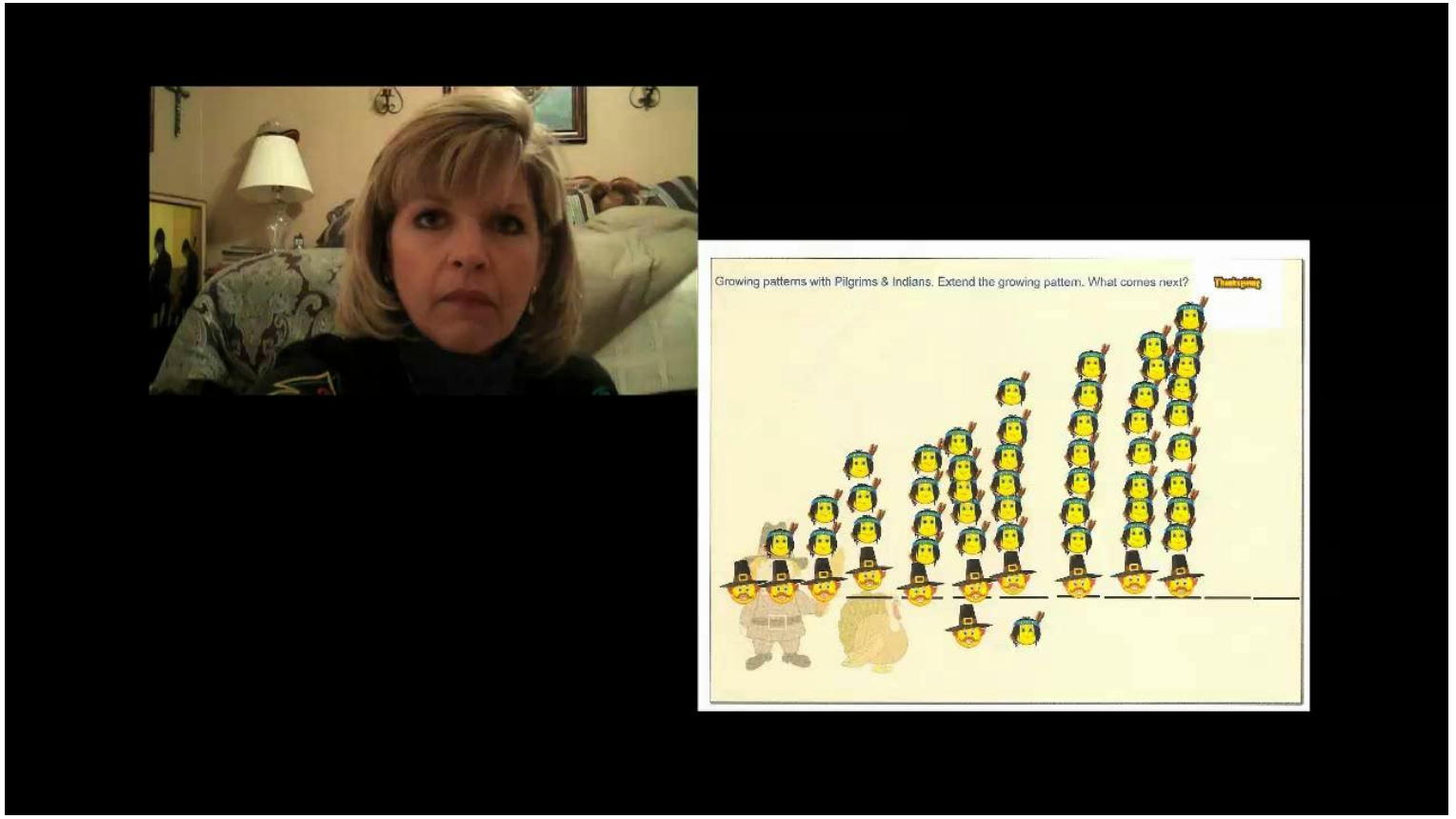
Structures: Whole Class with a SmartBoard; computer lab for individual projects

Strategies: Model, Lead and Test (MLT) - Model after giving the students time to explore; Lead using the SmartBoard to discuss what is happening with each pattern; Test by giving the students a chance to create on their own.

Activity: We have been working on growing patterns for the last few weeks. We began by having students build and follow a growing pattern given to them within a small group. After we worked for a few minutes, we discussed what makes this type of pattern different from others that we had made. Once the discussion was over, the groups had a chance to go back and make any 'corrections' they felt they needed to. Great discovery learning!! For the next week, we worked on building two different types of growing patterns on our classroom SmartBoard. Each day, students took turns adding the next piece. For this particular activity, the class went to the computer lab and used the KidPix program to create their own growing patterns.

Assessment: The teacher monitored students' progress as they worked individually. For those who struggled with creating their own growing patterns, printed cards were given so that students could simply extend a pattern. At the conclusion of the activity, all students printed their patterns and took them home to share with their families.

Post-program Teacher's Reflection on Student Learning



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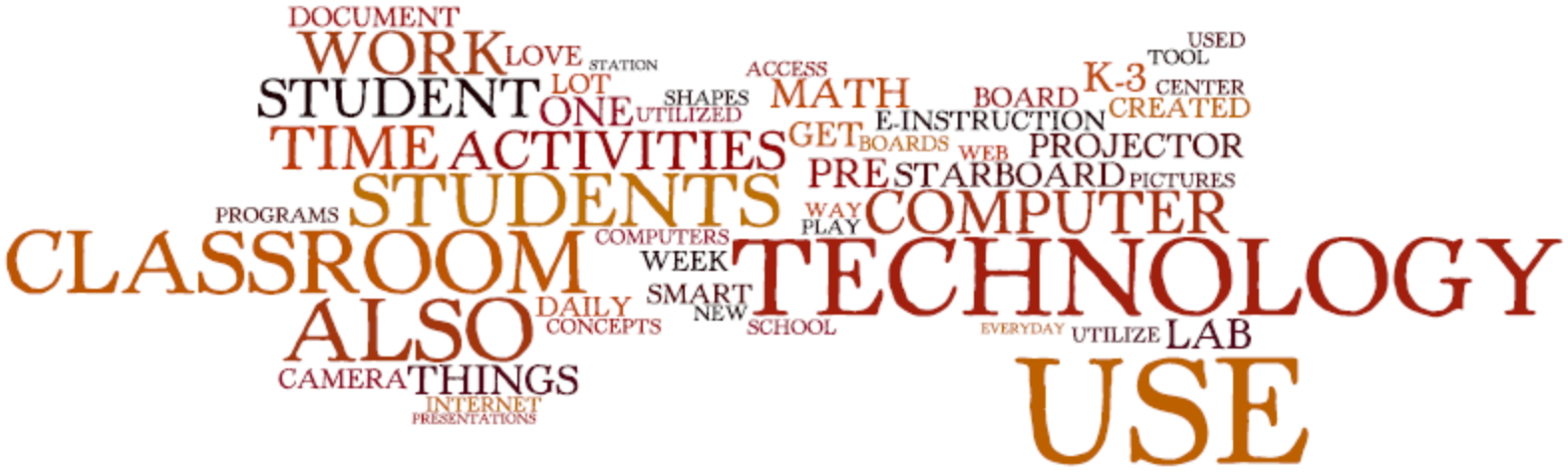
Technology for K-3 Classroom Instruction
Pre-Program Teachers' Reflections



50 most commonly-used words

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Technology for K-3 Classroom Instruction
Post-Program Teachers' Reflections

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