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EAST TENNESSEE STATE UNIVERSITY
Early Childhood Education

Designing a STEM Professional Development Program for Preschool Teachers, with Supports for DLLs

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SciMath-DLL

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Overview

- SciMath-DLL is a curriculum-independent, early childhood professional development (PD) model
- The purpose of SciMath-DLL is to improve teaching and learning around science, technology, engineering, and math (STEM) for all learners, including dual language learners (DLLs)
- This presentation reports on the iterative development process of the model

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Rationale

- Children from low-resource communities and those who are DLLs are at greater risk for lack of school readiness in language, literacy, mathematics, and science than those from higher-resource communities or those who are not DLLs

  (Barnett, 2008; Cognitive Development & Beyond Project, 2009)

- High-quality early STEM teaching is not common, and educators often do not feel well-prepared to teach STEM or work with DLLs

- SciMath-DLL model aims to fill the gap by providing teachers supports for high quality early STEM, and support their dual language learners (DLLs)

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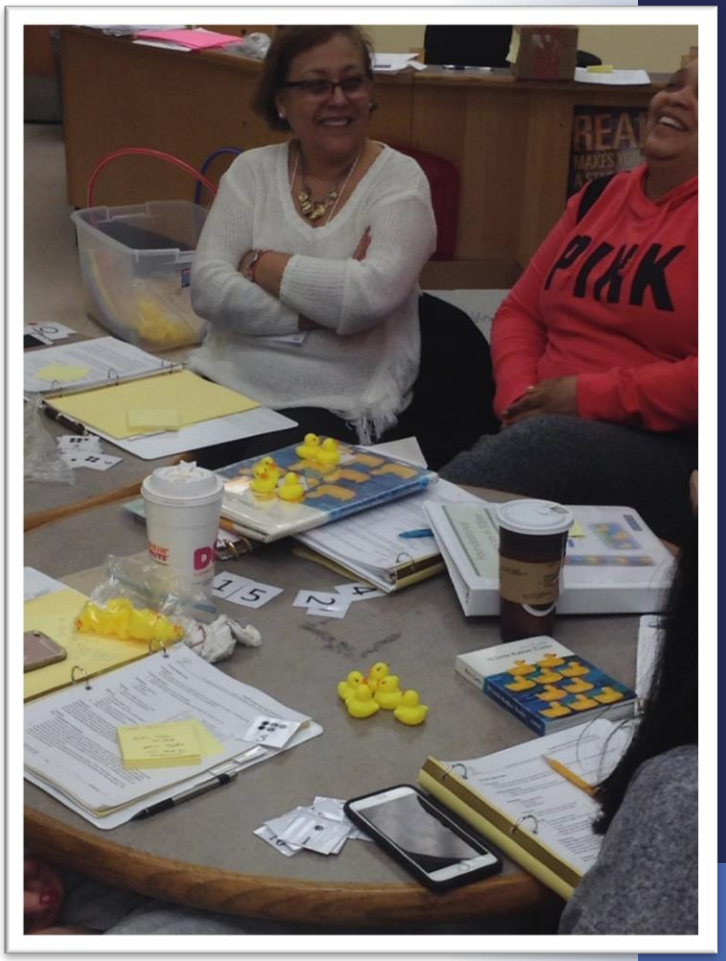
Research Questions

1. How was the SciMath-DLL model designed and developed?

2. What did we learn during the development process, and how did we address this in the project?



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SciMath-DLL Model

- SciMath-DLL PD supports are curriculum-independent and include:
  - Workshops
  - Reflective coaching cycles (RCCs)
  - Professional learning communities (PLCs)

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Components of SciMath-DLL

- Workshops provide educators opportunities to:
  - Learn key STEM content
  - Understand developmental theory
  - Learn strategies for working with DLLs
  - Explore these ideas hands-on

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Components of SciMath-DLL

- Reflective coaching cycles (RCCs) begin with teachers engaging children in a focal lesson
- After the lesson, the teacher, coach, and researcher provide written reflections on the activity, watch the video, and meet to discuss

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Example of Teacher Reflection Form

TEACHER REFLECTION LOG (TRL)

Teacher Name:	Center/School:
Coach/Master Teacher Name(s):	Coaching Cycle Number:
How Topic Chosen: ☐ SciMath-DLL SGLE ☐ Teacher ☐ Coach/MT ☐ Teacher & MT ☐ Other: _____ Focal Area: ☐ Math ☐ Science ☐ Both ☐ Other: _____ ____ # of children participating-attending K next year ____ # of children participating-not attending K next year	
Date of Classroom Visit by coach/MT	Date: Start Time: End Time:
Date of Conference/Meeting	Date: Start Time: End Time:

Reflection Coaching Cycle Procedure: 1. Do activity; 2. Reflect on paper; 3. Discuss with coach/MT and plan next steps (View videotape; Discuss lesson; Plan next steps)

1. **ACTIVITY**
   Description of teaching activity (e.g., science-observing, describing apples):

2. **REFLECTION** (Complete after lesson, before reflection meeting/conference)

What went well:	**Evidence:**
What might be changed next time:	**Evidence:**

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Components of SciMath-DLL

- The professional learning communities (PLCs) involve educators presenting a problem of practice around STEM to colleagues and soliciting feedback
- PLCs follow a modified "Tuning Protocol"

Date of Lesson: _____ Date of PLC: _____
Teacher Name: _____ Format (check one): ☐ Online ☐ In-person ☐ Hybrid
School/Site/Center Name: _____
Brief lesson description (e.g., *science, making playdough SGLE)*: _____

- **Please attach your lesson plan.**
- **Please attach any documentation of children's work** (if applicable) that you would like to share, such as scans or photos of their finished work, or follow-up activities.

General Information

1. **What are the ages of the children who participated in your lesson?** (# of children for each group)

	# of Children	# attending Kindergarten next year?	# in preschool the prior year?
3-year-olds			
4-year-olds			
5-year-olds			

2. **Do any of the children in your small group have special needs or IEPs? Yes___ No___** If yes, how many? _____
   If yes, in what area of development? (Please select):
   ___Cognitive ___Phys/Motor ___ Social/Emotional ___Adaptive/Self-help
3. **How many are DLL?** _____
4. **Please describe the children's language skills: (# of children)**
   Responds to and uses non-English first language only ____
   Responds to English in the first language ____
   Uses some English phrases ____
   Uses some English sentences with minor errors _____
   Uses English sentences without errors ____
   Participates in conversations in English ____
   Non-verbal ____
5. **Are you fluent in another language other than English? ____ If yes, which language(s)? _____**

Information About The Lesson

6. **Did the students have an opportunity to play with the materials prior to the lesson? Yes__ No__**
   If yes, when? (Check all that apply):
   _____ In a preceding small group activity
   _____ During large group time
   _____ At free play
   _____ Other (please describe):
7. **How many students do you believe understood the concept(s) or met the objective(s) of this lesson?**_____
8. **How did you assess children's understanding?** (check all that apply)
   ____ Asked informative/clarifying questions that reveal understanding
   ____ Asked the child to perform a task or solve a problem
   ____ Collected anecdotes of students remarks, questions, & responses
   ____ Collected sample work____ Other (please describe)_____
9. **FOCAL QUESTION(S)**. List one or two focal question(s) to which you would like your colleagues to respond and give you feedback. This should be an issue(s), question(s), or challenge(s) you had/have about the lesson. (e.g., *Children had trouble focusing on the activity as they took turns adding ingredients to the big bowl to make play dough. What suggestions would you have to keep their attention?*
   Focal Question(s):

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Sample

- Study 1: 45 teachers, 8 master teachers (coaches), 2 cohorts in 3 public school districts in New Jersey across 4 years
- Study 2: 25 teachers (and 25 in control), 6 coaches, from a new school district in New Jersey (currently in year 3 of 4)
- Purposeful sample: committed to providing feedback on the model and fully participating in the project

(Patton, 1990)

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Data Sources

Table 1. Qualitative data sources

		Study 1				Study 2*	
Source	**Type**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 1**	**Year 2**
Design Group (DG) meetings	Notes/minutes	✓	✓			✓	✓
Scientific Advisory Group meetings	Notes/minutes	✓				✓	✓
End of year meetings	Notes/minutes		✓	✓	✓		✓
External evaluator reports	Educator surveys		✓	✓	✓		✓
Educator feedback on workshops	Educator surveys	✓	✓	✓	✓		✓
Master teacher trainings	Notes/minutes				✓		✓
PLCs	Notes/minutes		✓	✓	✓		✓
Reflective coaching cycles	Reflection logs		✓	✓	✓		✓
Anecdotal data	Emails, conversations	✓	✓	✓	✓	✓	✓

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Data Analysis

- Qualitative data were coded inductively using the "grounded" approach

(Glaser, 1965)

- We used Dedoose to facilitate analysis

(SocioCultural Research Consultants, 2013)

- To support the validity of our analysis:
  - We gathered data over a multi-year period
  - Used triangulation where possible
  - Drew on direct quotes and rich data to make our conclusions

(Maxwell, 1996)

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Project Structure

- We modified workshops and other resources based on feedback provided by educators, design group, and scientific advisory group
- After year 1 of study 1, we restructured workshops to include:
  - Activities to demonstrate classroom applications of our approach and the theory
  - Provide time for teachers to work in small groups
  - Developed SGLEs

- "Workshops are better now…These are more interactive, more like a preschool day. We look forward to going to them…We know we'll leave with at least one activity the kids will benefit from."

End of year meeting, Study 1, Year 3

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Example of an SGLE

SciMath-DLL

Small Group Learning Experiences
Foundational Experiences in STEM: Exploring Water

WATER DROPLETS (*Properties of Water*)

Description

Exploring water droplets provides children with foundational experiences with water. Water sticks to itself (cohesion), and it sticks to other things (adhesion). On some surfaces, water will form half drops. On other surfaces, water will not form any drops. To watch water stick to itself, merge two water drops together to make a bigger drop! Using various materials listed below, children will observe, discuss, document, and explore water's sticky properties!

Learning Objective(s)

- Children will learn that water sticks to itself (cohesion).
- Children will learn that water sticks to other things (adhesion) in different ways.

Vocabulary

- angle (*ángulo*)
- drops (*gotas*)
- slant (*inclinación*)
- sticky (*pegajoso*)
- surface (*superficie*)

Literature

For Children

- *A Drop Around the World*, by Barbara McKinney
- *A Drop of Water*, by Walter Wick
- *I Get Wet*, by Vicki Cobb
- *I Love the Rain*, by Margaret Park Bridges
- *Puddles*, by Jonathan London
- *Raindrops*, by Larry Dane Brimner
- *Splash! Poems of Our Watery World*, by Constance Levy

For Teachers

- *Exploring Water with Young Children*, by Ingrid Chalufour and Karen Worth
- PEEP and the Big Wide World - Explore Water: http://www.peepandthebigwideworld.com/guide/water.html
- *Marvelous Explorations Through Science and Stories (MESS)* http://eclkc.ohs.acf.hhs.gov/hslc/tta-system/teaching/eecd/domains%20of%20child%20development/science/investigatingwater

Tips for DLL

The teacher should consistently support children's understanding of instructional talk with use of relevant real-life objects, pictures and hands-on experiences. In addition, the teacher may employ the following strategies: using slower simplified language, emphasizing important words, rephrasing and repeating key words, occasionally translating new words or concepts from English to the Home language (e.g., "Water droplets en español son gotas de agua"). A discussion about the different ways that water can drip, leak, or gush can help to make the semantic distinction of what a drop or droplet is in relation to these.

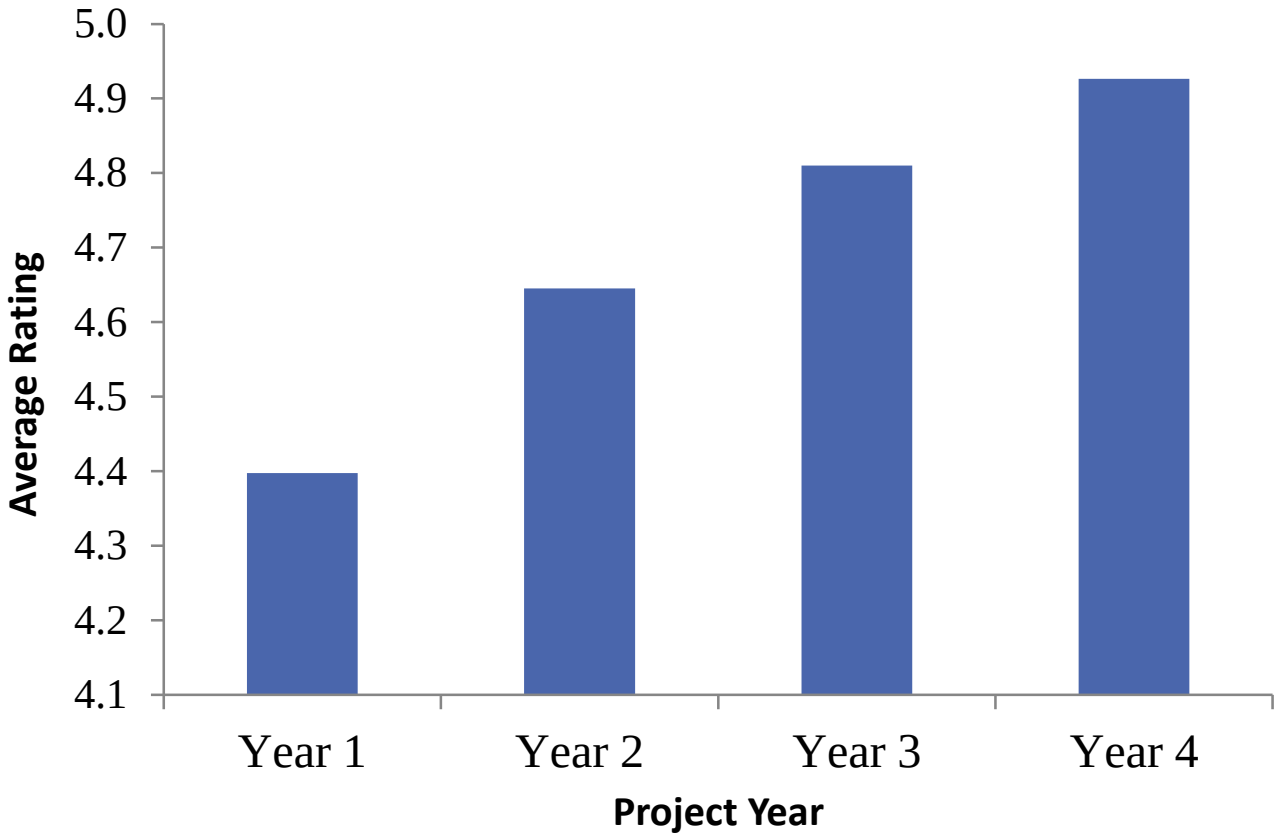

Figure 1. Average workshop rating out of 5 by project year

DLL Supports

- "I would like to find support for dual language learners when it comes to science. Of course, visuals and hands-on activities are beneficial but I have seen what a difference it makes to know a few "words" in Spanish when doing something like a science experiment."

RCC, Study 1, Year 4

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DLL Supports

- We created one DLL-focused workshop module in Study 1 and created a second one in Study 2
- In Study 2, we translated our lessons and PowerPoint slides into Spanish to support educators in their delivery of STEM content to Spanish-speaking DLLs
- Eighty-six percent of educators rated the impact of these materials as very or extremely positive

External evaluation,
Study 2, Year 2

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Significance of Work

- The purpose of SciMath is to improve preschool educators' strategies for supporting STEM learning for children who are most at-risk for lack of kindergarten readiness and for later academic difficulties

- Enhancing educators' abilities to teach STEM is critical for assuring that all students, regardless of family economic or language status, have opportunities to learn significant STEM content and skills

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Next Steps

- Our next step is to evaluate effects of participation in the SciMath-DLL model experimentally on educators and on children in Study 2 (underway)
- This is a randomized control trial
- We are now:
  - Finishing our second year of working with the treatment group
  - Posttest data collection is ongoing, for classroom, educators, and children
- We expect to have preliminary results by fall 2017

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Thank you!

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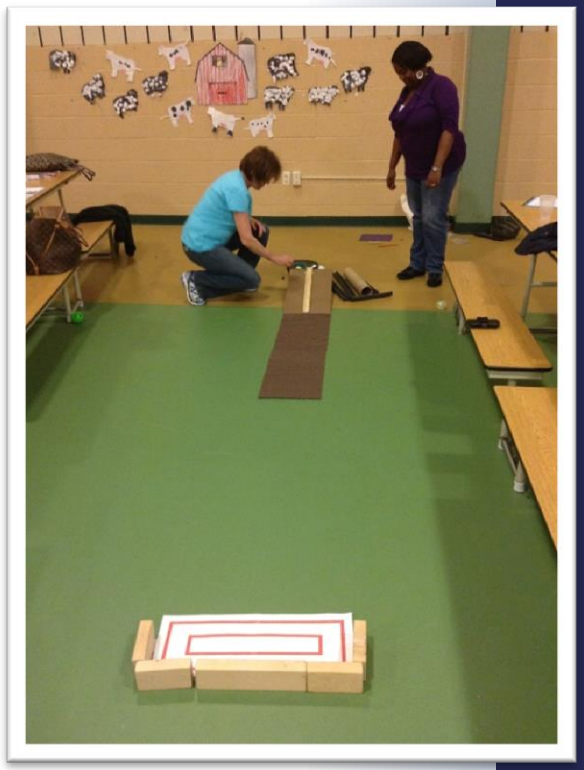

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