Designing an Innovative Professional Development System to Support STEM Teaching for Dual Language Learners

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Introduction

The aim of the SciMath-DLL project is to design and carry out preliminary testing of a professional development (PD) approach that integrates high-quality math and science instructional offerings with supports for preschool dual language learners (DLLs) and all learners. The need to improve early math and science instruction is well documented, especially for children at risk for lack of kindergarten readiness, such as DLLs.[1] Rich STEM experiences provide critical communicative opportunities that can support language, math, and science learning.[2,3] By engaging in an iterative design process with practitioners, our goal is to create a PD system that is both effective for improving practice and practical to implement.

Research Questions

1) What are the challenges to implementation? How have they been overcome?

2) What are the initial impacts of the project on teachers?

Method

Iterative Design Team
- pre-K teachers
- master teachers
- PD providers/researchers
- early childhood/STEM experts

Primary PD Components
- reflective coaching cycles (4/year)
- workshop modules (8/year)
- workgroups (6/year)

Data Analysis
Data sources from multiple project years were analyzed using mixed-methods (Table 1). Qualitative analyses guided by grounded theory were completed using Dedoose software,[4] complemented by quantitative analyses.

Table 1. Selected sources of data

Source	Types
Reflective cycles	Reflective logs and observation notes
Workshops	Plans, notes & feedback
Workgroups	Meeting notes, agendas
External evaluations	Reports based on independent surveys of participants
Design groups	Meeting notes, agendas
Scientific advisory group	Meeting notes, agendas

Results & Key Findings

Research Question 1: What are the challenges to implementation? How have they been overcome?

Table 2. Select challenges to implementation & resolutions

Challenge	Resolution
District Policies: **Novelty of reflective cycle**	- Designed and added workshop for coaches
Project Design: **Workshop format**	- Modified workshop format - Created sets of interactive, small group learning experiences to model pedagogy
Obstacles for Educators: **Lack of time**	- Modified protocol for flexible scheduling - Created online version of reflection form

"This project has really helped me understand the true meaning of the reflective cycle...it made me understand and be more clear what my role is..." – Master Teacher, Design Group Meeting
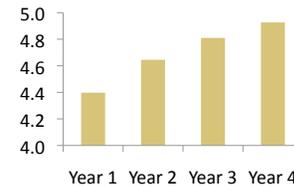

Figure 1. Average workshop rating out of 5 by project year

65% in Year 3

25% in Year 4

Percent of participants who reported challenges to full implementation listing "time" as a challenge

Research Question 2: What are the initial impacts of the project on teachers?

Table 3. Examples of changes in teachers and practice

| Change in Teaching Practice or Attitude	Selected Evidence for Theme
Teaching math and science in a new way	*"This project has ...helped me to view teaching in a different, more effective way....I now see how important it is to also let the students explore, think, and problem solve on their own... "* Teacher, Design group meeting *"...once you introduce [the kids] to how many sides are in a shape they got it. Once I asked them to draw and they were like 'look, I did a triangle' and they started counting [the sides]. "* Teacher, End of year meeting notes
More intentional teaching	*"...I give more thought to preliminary steps in my lessons. I do more checking for understanding before moving on.... "* Teacher, External evaluation report Half of all participants reported changes in teaching related to greater depth and intentionality. Year 3, External evaluation report
Choose an appropriate amount of lesson content	
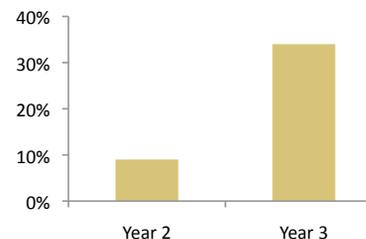
Figure 2. Percent of reflections referring to amount of lesson content that note teachers using "just the right amount"

Results (Cont.)

Teachers report changes in children's learning and attitudes as well.
- Greater understanding of math and science concepts
- Increased use of math and science language
- Increased interest and engagement
  - Year 3, External evaluation report

A new NSF-funded project will evaluate the impacts of the SciMath-DLL model on teachers and children experimentally.

Conclusion

The SciMath-DLL model became more useful and effective as a result of the iterative design process. Participation in the project improved teachers' practice around teaching science and math to young learners, and it may lead to improvements for the children they teach as well.

References

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[3] Sarama, J., Lange, A. A., Clements, D. H., & Wolfe, C. (2012). The impacts of an early mathematics curriculum on oral language and literacy. *Early Childhood Research Quarterly, 27*(3), 489-502.

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More Information

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