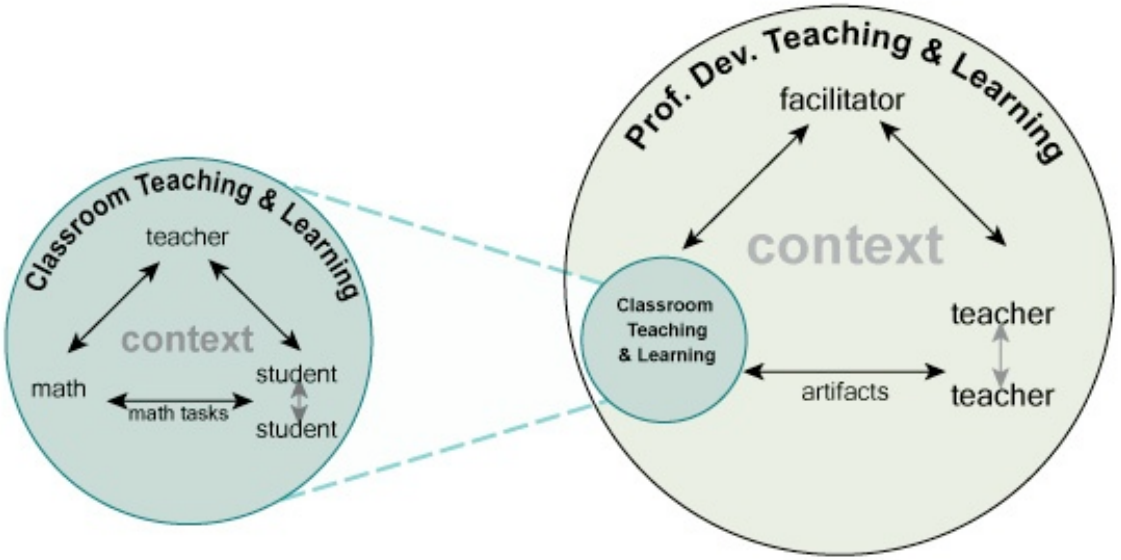
# Understanding the Fidelity of Implementation and Scalability of Mathematics Professional Development Curricula

- Nanette Seago (*Learning and Teaching Geometry*)
- Babette Moeller (*Supporting Staff Developers*)
- Hilda Borko (*Implementing the Problem Solving Cycle project*)

# “Content” of PD



# Types of PD

- Highly specified
  - Learning to Teach Linear Functions/Geometry
  - Math for All
  - Addressing Accessibility in Mathematics
  - Fostering Algebraic/Geometric Thinking
  - Developing Mathematical Ideas
- Emergent/adaptive
  - Problem Solving Cycle
  - Video Clubs

# Fidelity with respect to

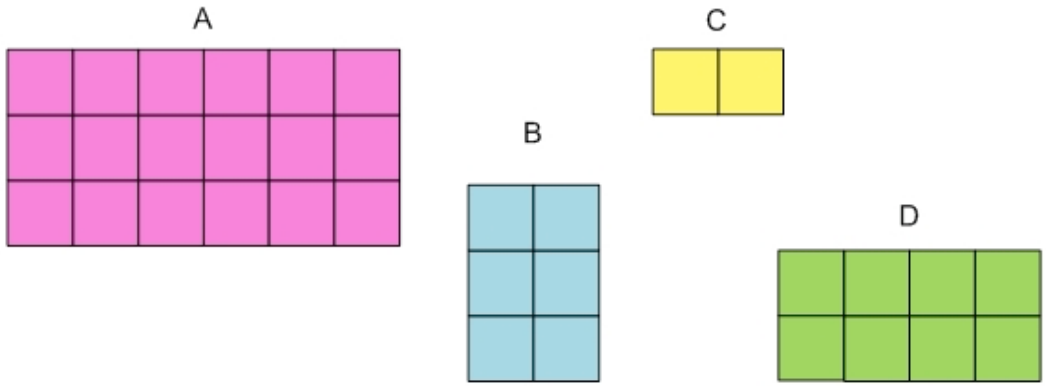
- Enacting the activities specified in materials
  - "coverage"
- Enacting the intent of the program
  - "adaptation"

# Questions we'll consider

- How are the different projects conceptualizing and assessing "fidelity"?
- What are we finding?

# Learning and Teaching Geometry:

## *Videocases for Mathematics Professional Development*




*Nanette Seago,* WestEd

# Outline of My Presentation

- Overview of Project
- What we mean by Fidelity of Implementation
- How we intend to measure it
- How we envision designing for it

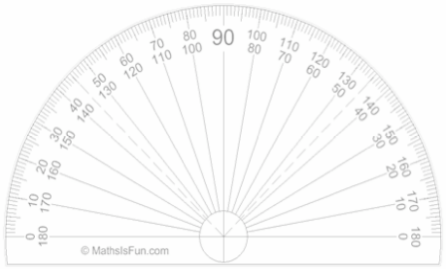

# Learning and Teaching Geometry
# Project Overview

- In year three of a 5-year National Science Foundation project
- Developing videocase-based, PD materials
  - **1 Foundation Module**
  - 4 Extension Modules

- Staff: Nanette Seago (PI), Mark Driscoll (Co-PI), Jennifer Jacobs, Johannah Nikula, Patrick Callahan, Hilda Borko
- Advisory Board:Harold Asturias, Tom Banchoff, Phil Daro, Megan Franke, Karen Koellner, Glenda Lappan, Hung-Hsi Wu
- Evaluation Team: [Horizon Research, Inc.] Dan Heck, Kristen Malzahn, Courtney Nelson


# LTG Materials

- Built around authentic video clips from grades 6-8 classrooms
- Focus on similarity and its mathematical use in teaching
- Modular in design--coherent, sequenced set of videocase professional development sessions
- Well-specified facilitator support materials:
  - Explicitly communicates the underlying core principles
  - Clearly laid out rationale for principles
  - Detailed sample agendas and mathematical notes designed with an eye toward making the design and values explicit
- Foundation module: ten, 3 hour sessions

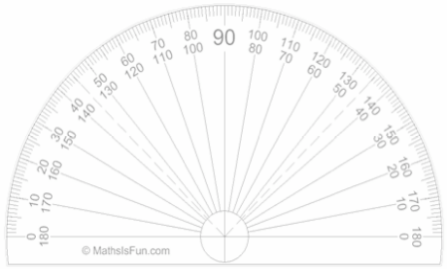



*A sequence of learning experiences*

# LTG Foundation Module Map

| Session 1 | Session 2 | Session 3 | Session 4 | Session 5 | Session 6 | Session 7 | Session 8 | Session 9 | Session 10 |
|---|---|---|---|---|---|---|---|---|---|
| *Congruence and "Sameness"* | *Static & Dynamic Views of Similarity* | *Relationship Between Dilation and Similarity* | *Preservation of Angles through Dilation* | *Preservation of Angles & Proportional Lengths through Dilation* | *Ratios Within and Across Similar Figures* | *Ratios Within and Across Similar Figures* | *Connections between Similarity and Slope & Linearity* | *Area of Similar Figures* | *Closure and Re-capping of Big Ideas* |

**Defining Congruence and Similarity** | **Relationships and Attributes of Similar Figures** | **Connections** | **Closure**




# LTG Foundation Module Goals

- Help teachers develop a deep, flexible understanding of similarity
- Promote a dynamic, transformational view of similarity, and geometry in general.
- Provide insight into students developing conceptions of similarity
- Equip teachers with *specialized content knowledge* in the area of similarity

# Specialized Content Knowledge (SCK)

*"The mathematical knowledge and skill unique to teaching- not typically needed for purposes other than teaching. This work involves an uncanny kind of unpacking of mathematics that is not needed--or even desirable--in settings other than teaching. Many of the everyday tasks of teaching are distinctive to this special work."*

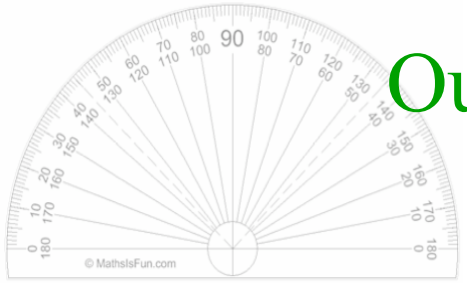
(Ball, Thames, & Phelps, 2008)


# Defining Fidelity and Adaptation

*Fidelity means acting in accord with the core principals explicated in the professional development materials*

*Adaptation means not using the materials strictly as written/scripted.*

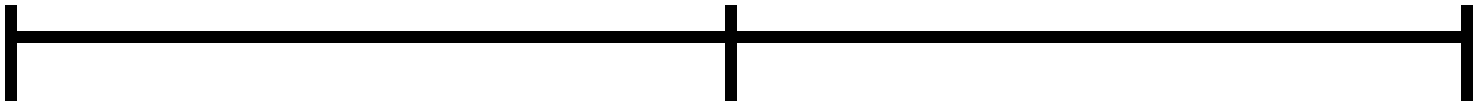
*We believe that adaptation is inevitable because it means to take seriously the context in which the materials are used. In adapting materials, some actions are consistent with the underlying values and some are not.*




# Our Views of the Relationship between Fidelity and Adaptation

*We assume that all facilitators will make adaptations. It is also assumed that not all adaptations are productive or of the same magnitude.*

## CATEGORIES OF ADAPTATION



### Fatal

Adaptations that seriously undermine critical components of the materials because they are contrary to the design, principles or values

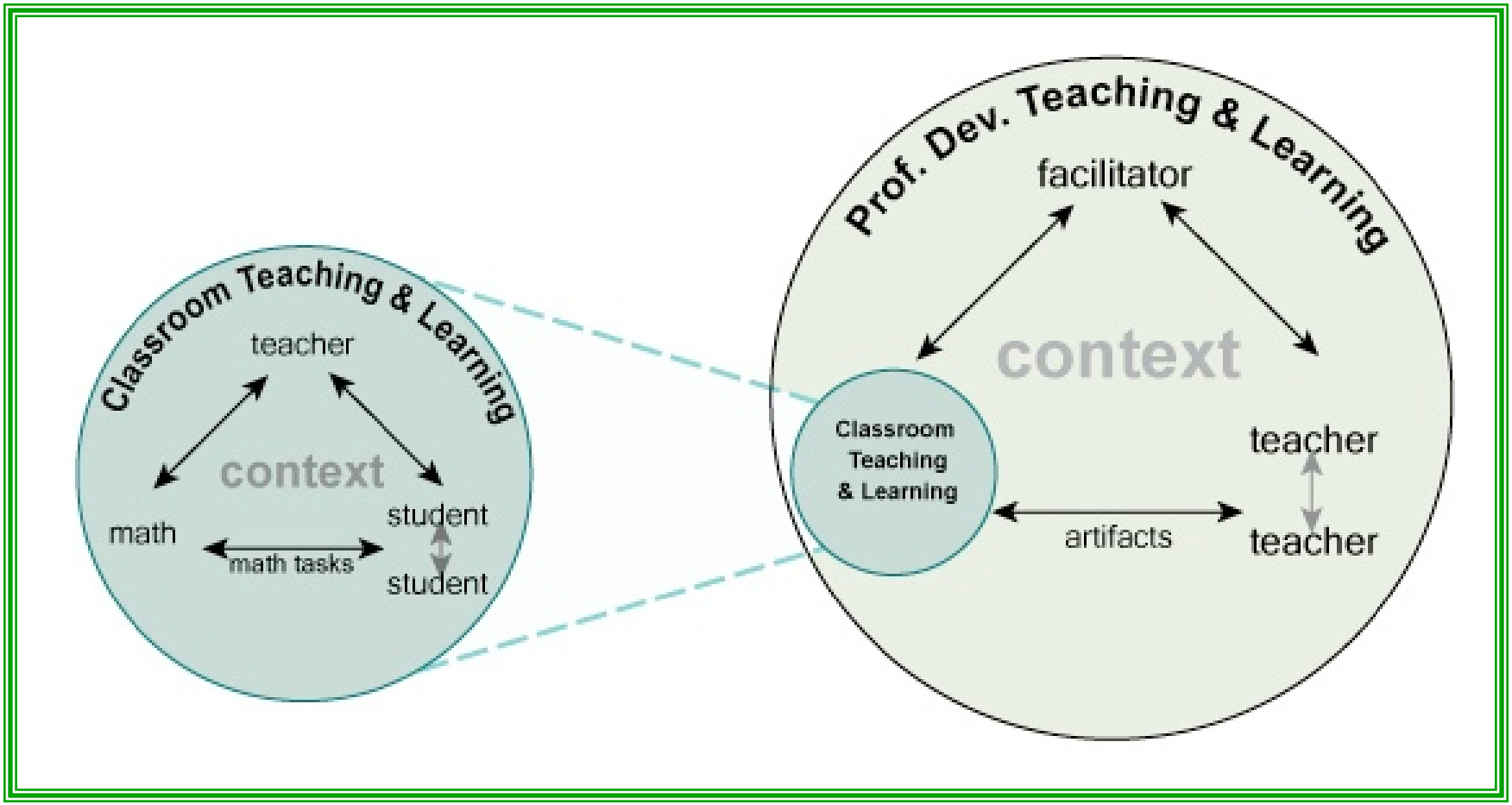
### No Impact

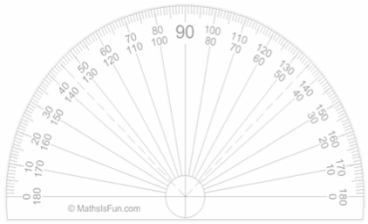
Adaptations that are neutral and have no impact: "no harm, no foul"

### Productive

Adaptations made that relate to particular participants in particular contexts, while remaining consistent with the design, principles and values.

# Frame for Examining Fidelity and Adaptation





# Measures of Adaptation and Fidelity

- "Adherence to" and "Focus on":
  - Mathematical storyline
  - Pedagogical storyline
- Data collection:
  - PD session logging tool
  - Facilitator interviews
  - PD session observations jointly conducted by author and evaluator
  - Evaluator follow-up interview with author

# Designing for Adaptation and Fidelity

- In an effort to create well-specified materials aimed at supporting facilitators to use the materials in accordance to the core principles, we will use our research data to inform the content of the facilitation materials.
- Based upon our prior experience, we predict that some areas of adaptation that facilitators will need support are:
  - Dealing with time constraints
  - Addressing the mathematical needs of the group
  - Taking advantage of "Openings" to advance overall goals
  - Adhering to the storyline and sequence--trusting the whole design
  - Dealing with physical constraints

# Questions? Comments? Ideas?

*We Welcome them!*

*Nanette Seago,* nseago@wested.org

# Supporting Staff Developers Project

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# Key Project Staff

- Babette Moeller, PI
- Lynn Goldsmith, Co-PI
- Amy Brodesky, Co-PI
- Kristen Reed, Researcher
- Ashley Lewis, Researcher

# Purpose of the Supporting Staff Developers Project

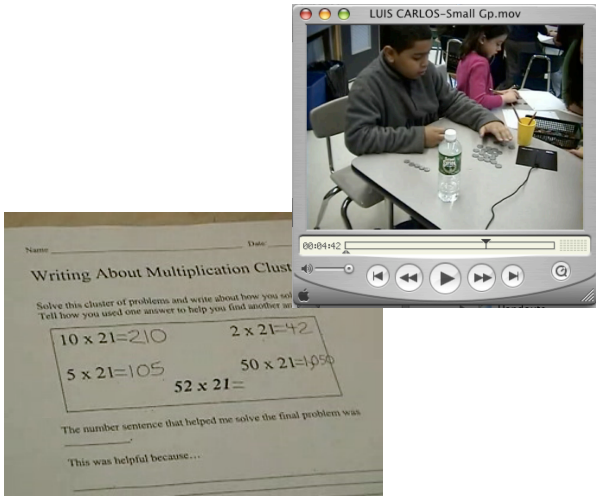
To investigate the effectiveness of different kinds of **supports** that are designed **to develop the capacity of teachers leaders** to effectively **implement curriculum-based professional development programs** focused on broadening teachers' preparation to make math lessons more accessible to a students with different strengths and needs in their school districts.

# Professional Development Programs Studied

- *Math for All* (focus on grades K-5)
- *Addressing Accessibility in Mathematics* (focus on grades 6-8)
- Both programs are designed to enhance teachers' knowledge and skills in making math lessons accessible to students with disabilities with out undermining the academic rigor of the math lessons

# Key Features of the PD Programs

- Co-facilitated by math and special education staff developers
- Attended by teams of general and special education teachers
- Teachers engage in the analysis of student work (on paper or on video) to better understand their strengths and needs

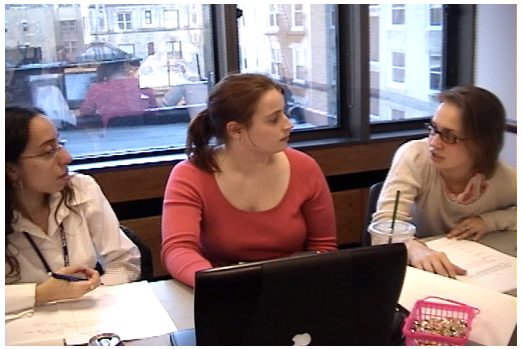



# Key Features of the PD Programs

- Teachers share and discuss instructional strategies and practices that help to make mathematics lessons accessible to learners with diverse strengths and needs
- Teachers engage in the analysis of the learning goals of math lessons
- Teachers work on lesson planning assignments that they carry out in their classrooms

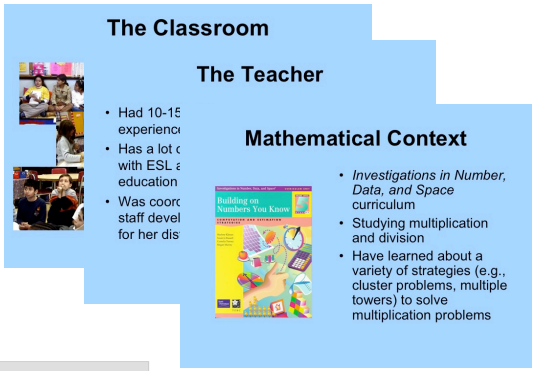
# Key Features of the PD Programs

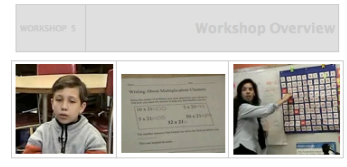
- Teachers reflect on their practice
- PD is conducted in multiple sessions during the school year

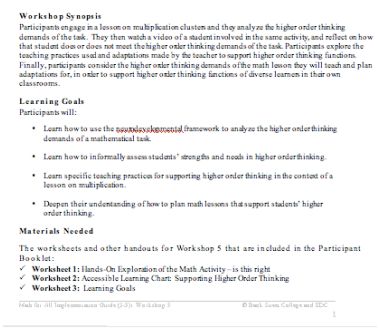


# Materials Provided to Facilitators

- PowerPoint with video files
- Printed facilitator guide including annotated PowerPoint slides
- Handouts for Participants
- 1-day orientation



**Workshop Synopsis**

Participants engage in a lesson on multiplication clusters and they analyze the higher order thinking demands of the task. They then watch a video of a student involved in the same activity, and reflect on how that student does or does not meet the higher order thinking demands of the task. Participants explore the teaching practices used and adaptations made by the teacher to support higher order thinking functions. Finally, participants consider the higher order thinking demands of the math lesson they will teach and plan adaptations for, in order to support higher order thinking functions of diverse learners in their own classrooms.

**Learning Goals**

Participants will:

- Learn how to use the [illegible] framework to analyze the higher order thinking demands of a mathematical task.
- Learn how to informally assess students' strengths and needs in higher order thinking.
- Learn specific teaching practices for supporting higher order thinking in the context of a lesson on multiplication.
- Deepen their understanding of how to plan math lessons that support students' higher order thinking.

**Materials Needed**

The worksheets and other handouts for Workshop 5 that are included in the Participant Booklet:

- ✓ **Worksheet 1:** Hands-On Exploration of the Math Activity – is this right
- ✓ **Worksheet 2:** Accessible Learning Chart: Supporting Higher Order Thinking
- ✓ **Worksheet 3:** Learning Goals

# Phase I Pilot Study

- Our pilot study involves the implementation of each of the two PD programs by 5 different teams of facilitators in 5 different sites
- Opportunity to pilot test instruments for larger scale study
- Research Questions:
  1. How are facilitators implementing the PD program using the facilitator materials provided?
  2. In what areas do facilitators need additional support to implement the PD programs more effectively?

# Fidelity of Implementation

- Alignment between the program developers' intended opportunities to learn and the opportunities to learn in the enacted PD (Brown, Pitvorec, Ditto, & Kelso)
- Alignment of enacted PD with written PD
- Coverage of content

# Measuring Fidelity

- Pre- and Post-Interviews
- Pre- and Post-Surveys
- Facilitation Logs
- Observations
- Video recordings
- Collection of artifacts
- Annotated facilitator guide

# Analyzing Fidelity

- Compare enacted PD to PD described in the facilitator materials (facilitator guide, PowerPoint)
- Eventually:  What are teachers learning under different enactment conditions?

# What Changes are Facilitators Making?

- Surprisingly few changes--Facilitators stay close to the "script" and carry out the activities as outlined in the facilitator guide
- Some changes are planned ahead of time
- Some changes occur as the PD unfolds

# Examples of Planned Changes

- Eliminating the reading of the curriculum guide for a math lesson under study
- Creating a handout that lists additional instructional strategies
- Using different examples to illustrate a type of math problem (e.g., multiplication cluster problems)

# Why are facilitators making the planned changes?

- Not enough time
- To adapt the PD curriculum to their specific audience's needs and interests
- To expand on content (extra handouts, different examples)

# Examples of Spontaneous Changes

- Not probing deeply enough in discussions of video
- Not holding participants responsible for reporting back on their assignments
- Picking up on (or skipping) teachable moments
- Not making participants reflect on their learning

# Why are they making spontaneous changes?

- Running out of time
- Level of discomfort with facilitator role by less experienced staff developers
- Understanding (or lack thereof) of the goals of the PD program/consistency of goals of the PD program with the goals of the district

# Initial Reflections

- Different instruments/methods are suited for measuring different aspects of fidelity
- Planned changes are easier to document than spontaneous changes
- Planned changes tended to be more consistent with the goals of the PD programs. Spontaneous changes could be either consistent or inconsistent.
- Degree of adaptation of the PD programs may change over time

# Contacts

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# Professional Development and Research Team

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- Jennifer Jacobs
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- Ed Wiley
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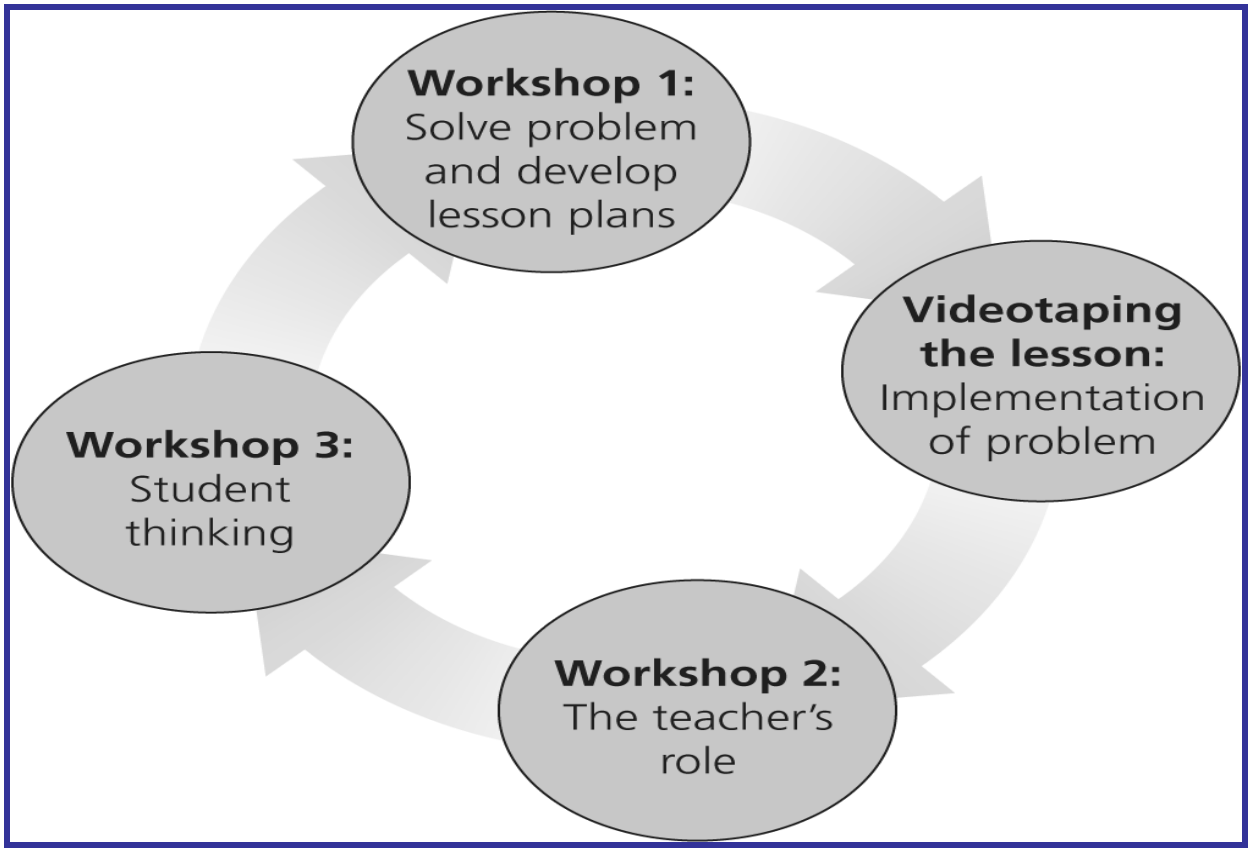
- Melissa Colsman
- Rachael Risley
- Sarah Roberts
- Adam Van Iwaarden

# Problem Solving Cycle



# PSC: "Adaptive" PD

- Facilitators make design decisions, taking into account the local context
- Flexibility in the focus of PD including:
  - Mathematical terrain
  - Instructional practices
  - Eliciting and building on student thinking
- Decisions take into account the needs and interests of the teachers and the district

# iPSC Efficacy: Effective, Scalable and Sustainable?

- Key questions:
  - EFFECTIVENESS: Is it effective in improving student learning and achievement?
  - SCALABILITY: Can it be adapted to different contexts?
  - SUSTAINABILITY: Can it be successfully enacted by different instructional leaders?
- Sustainability and scalability, although conceptually distinct, cannot be determined independently (mutually constituted)

# Scaling Up the PSC: iPSC

- Produce facilitation materials
- Build capacity: prepare facilitators
  - Provide preparation and support over 3 years
- Analysis of implementation (scalability & sustainability)
  - Fidelity of PSC workshops
- Analysis of impact (effectiveness)
  - Facilitators
  - Teachers
  - Students
- Produce refined facilitation materials

# Research Design (Initial)

- 7 Mathematics Instructional Leaders from 4 middle schools in a single district
- Content focus: ratio & proportion
- 4 meetings Spring 2008
  - Introduction and baseline measures
  - 1 iteration of the PSC
- Leadership Academy June 2008
  - Prepare ILs to facilitate the PSC
- Two cycles of PSC AY 08-09; 2 AY 09-10
  - 5 Mathematics ILs from 3 middle schools

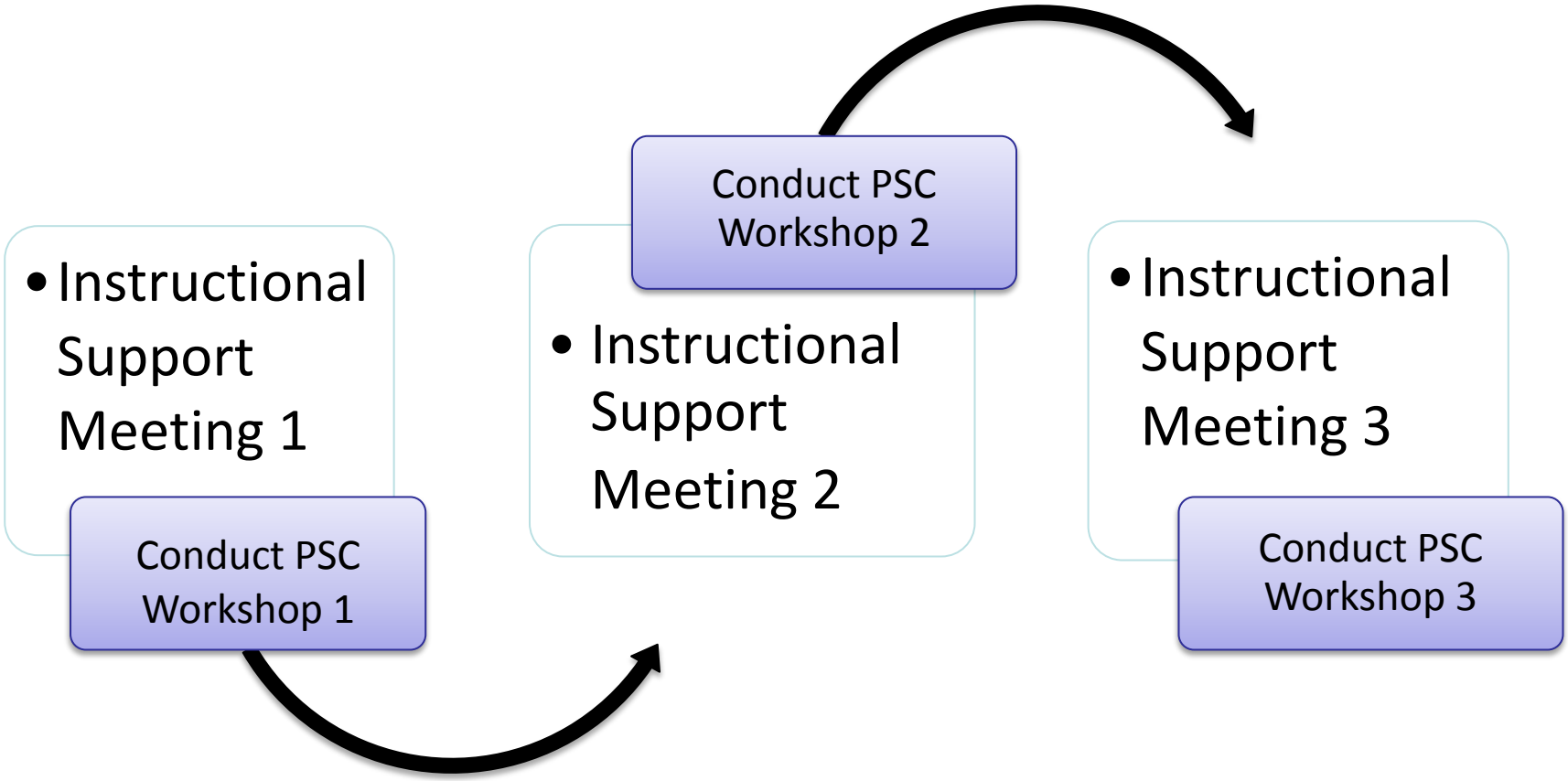
# Research Design (Current)

- New math coordinator with new vision
  - "Transitional" year
  - Continuing expansion
- Participants: oldtimers and newcomers
  - 3 returning ILs (2 schools)
  - 5 new ILs (4 schools)
- Revised intervention and research design
  - Year 2: oldtimers as leaders and models
  - "Complexified" analyses
  - Success of scalability and sustainability

# Summer Leadership Academy

- Transition to role as facilitators
- Focus on core issues of PSC implementation
  - Fostering a professional learning community
  - Helping teachers develop KMT (SCK, KCT, KCS)
  - Selecting video clips to foster rich discussions
  - Promoting discourse around classroom video
- 1 week; 2 “mini” PSC cycles
  - Experience PSC as learners and facilitators
  - Use PSC problems planned for academic year
- Modeling → “guided practice” across mini-cycles

# Academic Year Support for the ILs



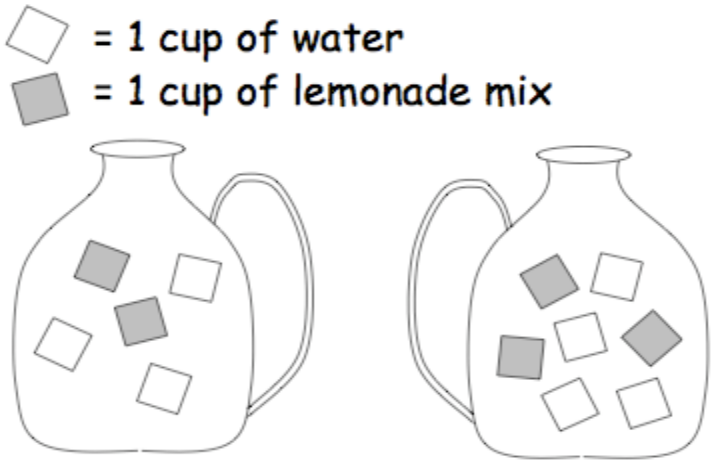
# Getting Started: The Analysis Plan

- Initial challenges
  - Uncharted territory: knowledge and skills needed to supporting teacher learning (Even, 2008)
  - Inevitable design modifications
  - Placing bets: A productive starting point
- Initial decisions
  - Initial analysis: fidelity (integrity) of implementation
  - Focus on PSC workshops (not ISMs or instruction)
  - Begin with Cycle 1: Lemonade Problem & continuing Ils
  - Compare to Cycle 4: Fuel Gauge Problem (tentative)
  - Analyze video and interviews

# Cycle 1: Lemonade Problem

Here are two recipes to make lemonade. The containers are full.

Which container will have the stronger lemonade flavor, or will they taste the same? Explain.




Adapted from Allyn & Bacon, 2007, p. 76

# Initial Analysis: Fidelity of Implementation

*Did the ILs implement PD workshops with integrity to PSC core principles?*

- How did the ILs adapt the PSC to their particular contexts?
- What were the reasons for their adaptations?
- To what extent did PD workshops maintain integrity with PSC core principles?

# Initial Analysis Questions

- Adaptation
  - What was the nature of adaptations?
  - What were the reasons for adaptations?
  - (How) did adaptations or reasons differ across workshops, ILs, core principles?
- Integrity
  - To what extent did PD workshops maintain integrity with PSC core principles?
  - (How) did extent of integrity differ across workshops, ILs , core principles?

# Data Sources

- **Video**
  - Summer institute
  - ISMs and **PSC workshops**
    - **Begin with Cycle 1, 3 continuing ILs**
  - Classroom lessons (PSC & baseline): ILs and case study teachers
- **Interviews**
  - **Several with ILs about PSC workshops** & classroom lessons
  - Case study teachers
- Knowledge of Math for Teaching (KMT) & Math Teacher Questionnaire (MTQ)
  - ILs and case study teachers
- Student CSAP scores (multiple years)

# Analytic Framework: PSC Core Principles

- Workshop design & structure: PD best practices
- Depth of Content
  - Mathematics (SCK)
  - Lesson planning
  - Instructional practices (KCT)
  - Student thinking (KCS)
- Workshop culture
- Overall quality

*Key Sources:*
*Facilitator's Guide; PDOP; Elliott, Kazemi, Mumme et al.*

# Initial Findings: Adaptation & Integrity

- Commonalities
  - Solving the problem
  - Discussions around video
- Differences: time and structure of workshops
- Differences: extent of focus on…
  - Multiple solution strategies
  - Needs of students (e.g., task adaptations)
- Differences: characteristics of video clips
  - Typical versus atypical (e.g., student strategies)

# Emerging Insights

- Knowledge of mathematics and pedagogy needed for facilitating PSC workshops
  - Differences between doing mathematics in PD and in the K-12 classroom
  - → Teacher Analysis Tasks versus Student Math Problems
  - Importance of focus on adapting tasks in ISM 1
- Integrity of implementation
  - Mutual adaptation: understanding school contexts and their implications for conducting/adapting the PSC
  - → 3-workshop cycle is not a core principle
- Balancing researchers' need to collect systematic data with ILs' need to adapt the PD to the realities of their district and schools

# iPSC: Implementing the Problem-Solving Cycle

http://psc.stanford.edu/