Taking a Deep Dive: Investigating PD impact on what teachers take up and use in their classroom

Karen Koellner, Arizona State University, Nanette Seago, WestEd, Nicora Placa, Hunter College

TaDD Project

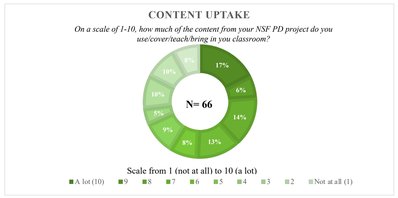
This three-year impact study, Taking a Deep Dive (TaDD) is collecting survey data, stimulated recall interviews, and video of classroom data from four large U.S. National Science Foundation PD projects in order to use case studies and cross case analysis to further inform:

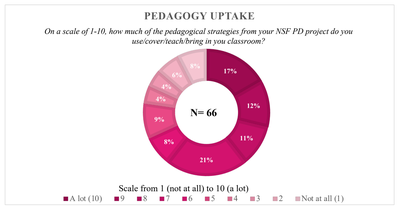
- *What teachers retain and implement in different PDs in different contexts;*
- *Why some teachers appear to retain and implement more than others; and*
- *Why some PDs have better results than others.*

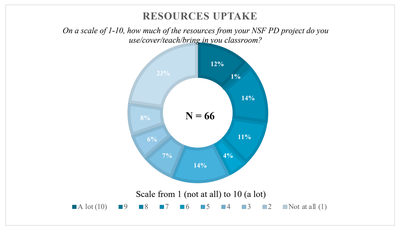
Our studies have examined the residual impacts of three different PD programs on teacher learning including 1) analyses of a survey that study participants completed in May 2019 which was 3-4 years post their PD experience, 2) an examination of role of representations on teacher and student learning, 3) our first case study of Briana.

Survey Results

- N = 66 (LTG had 28 participants, VAM had 25 and Lesson Study had 13)
- 32-question survey
- Questions focused on PD experiences - past and/or current use of the PD content, pedagogy and materials.
- The survey included
  - seven Likert scale questions (rate 1-10)
  - 18 follow up questions that allowed the participants to explain and provide more details about their numeric response







Background

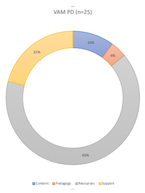
Understanding what teachers remember, take up and continue to use related to the intentions of the PD they attended may shed light on some of the mixed results from RCTs. There are many facets of professional development interventions from the goals and objectives of the PD related to content and pedagogy, the nature of the facilitator, as well as the materials, resources and supports that can potentially provide more nuanced qualitative evidence of teacher learning. This study examined teachers' perceptions about what teachers learned in one of three PD experiences 3-4 years after attending PD workshops and what they have taken up and continue to use related to content, pedagogy, resources and supports provided through the PD.

PD models fall on a continuum from adaptive to specified (Borko, et al., 2011; Koellner & Jacobs, 2015) and most typically embrace the agreed upon elements believed to be effective.

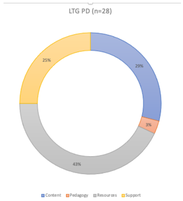
Adaptive-Specified Continuum

Percent of comments by Project Across Four Domains

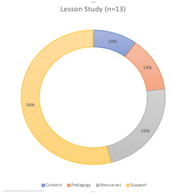
Descriptive statistics of teacher comments about the content, resources, pedagogy, and support of their PD experiences, by project (N=66)



Visual Access to Math
- Resources 65%
- Pedagogy 21%
- Content 10%
- Support 4%



Learning Teaching Geometry
- Resources 43%
- Content 29%
- Pedagogy 25%
- Support 3%



Lesson Study
- Support 54%
- Resources 23%
- Pedagogy 13%
- Content 10%

Discussion

- Teachers' perceptions of uptake differed across the three PDs.
- Teachers had clear recollections of the PD that they experienced, and these recollections were aligned with the PD goals and intentions.
- The nature of where a PD fell on the continuum appeared to be related to the degree with which they identified specific content, pedagogy and resources.
  - *The more specified the goals, the clearer teachers were able to indicate whether the PD was useful to the types of mathematics classes they were currently teaching. On the other hand, if the PD was more adaptive and the nature of the goals and intentions were evolving, teachers were less clear about the aspects of the PD that were relevant to their planning and teaching.*

Comparing teacher comments across projects, results of the analyses of covariance identified distinct patterns of comments about PD experiences for each group.
- LS participants were significantly more likely to mention support and pedagogy compared to both the LTG ($t=7.81$, $p<.001$ and $t=3.71$, $p<.01$, respectively) and VAM participants ($t=8.28$, $p<.001$ and $t=3.17$, $p<.01$, respectively). Their comments included principal and coach support as well as colleague support. Support was the domain qualitatively discussed most throughout the survey.
- LTG participants emphasized content significantly more than both LS ($t=5.51$, $p<.001$) and VAM participants ($t=6.22$, $p<.001$) and resources more than LS participants ($t=4.35$, $p<.001$).
- VAM participants mostly emphasized resources and did so significantly more than both LS ($t=8.55$, $p<.001$) and LTG participants ($t=5.62$, $p<.001$).

The Case of Briana

Briana is a case of a teacher that is motivated and engaged and likes to learn. She clearly had a positive experience with the LTG PD and we have strong evidence of learning five years post PD. Many of our findings are consistent with relevant research, provide more granular evidence about design elements and contribute new understanding about a teacher's perspectives about PD design elements related to her learning.

- The importance of having a community of learners
- Knowledgeable facilitator,
- aligned beliefs about teaching and learning,
- small bounded routines and
- the use of representations all appeared to be important factors to Briana's learning.

Additionally, an important finding related to the case of Briana is *where* the LTG PD fell on the specified- adaptive continuum. The LTG PD is a highly specified PD and Briana pointed to aspects of content, pedagogy and resources from each of the modules and they were all related to the specified goals and intentions of the PD.

We hypothesize that the specified nature of the PD and focus of the LTG PD along with particular design elements account for teacher learning.

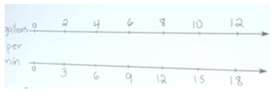
Visual Representations

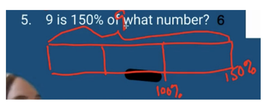
In order to better understand the what aspects of PD may influence sustained teacher learning, we explored the following research questions:
- *In what ways are ambitious mathematics practices advocated in PD sustained over time?*
- *In what ways do VRs play a role in teachers' learning and instructional practice?*

The two case study teachers were chosen because they participated in two different professional development (PD) experiences and sustained new teaching practices and learning four to five years after participating. Both PD projects focused on visual representations (VRs) and encouraged and modeled ambitious teaching practices. Teachers provided video clips and participated in interviews to illustrate and describe changes that took place in their learning and practice.

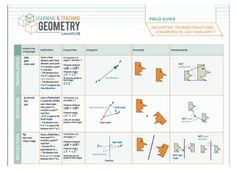
Below are three examples of the visual representations that the teachers from both projects talked about as having influenced them.

VAM Project





LTG Project



Multiple Case Study Design

A multiple-case study design was used to analyze the ways in which ambitious mathematical teaching practices were taken up and used in each of the teacher's individual contexts and how the teachers attributed this use to the PDs they attended. Findings suggest that:

- The teachers' use of VRs appears to be strongly connected to teachers' own active learning of VRs in PD
- VRs appears to be a key factor that supported the teachers' use of other ambitious teaching practices in their classroom
- The two teachers remembered and continued to use ambitious practices and VRs in their classrooms in ways that not only aligned to the goals and intention of the PD, but also adapted and extended representations to different mathematical domains and settings.

Implications

These cases provide evidence of two teachers that continued to use ambitious mathematics practices years after the PD support ended. Moreover, these ambitious mathematical practices were often tied to the use of VRs that teachers remembered learning about and using in their respective PDs. Implications for mathematics education leaders suggest that a focus on VRs may be one tool to anchor learning to deepen teachers' abilities to engage in ambitious teaching practices.

Next Steps

Currently 10 of our participants are part of our qualitative cross case analysis.
- They collected videotapes monthly from January 2021-December 2021. Participants time stamped clips in the videos that were related to their learning from the PD experience that they participated in.
- We conducted think aloud interviews where participants shared the videos with pairs of researchers.

Some of our ideas:
- PD programs that are located on different points along the continuum, we hypothesize that different design elements may be more critical to teacher learning depending where they fall on the continuum.
  - with a rigorous case study and cross case analysis – we will be able to contribute more to the uptake differences to inform the field.
  - teacher learning is greater and more robust than projects originally reported from their quantitative RCTs.
- We believe that design elements of PD are different depending on where the PD is aligned with the adaptive – specified framework.

Lesson Study (LS) PD
Aimed to engage in design research to develop and implement a replicable model for a coherent, department-wide approach to professional learning focused on creating classroom environments that produce students that can be powerful mathematical thinkers.

Visual Access to Mathematics (VAM) PD
VAM's goal was to improve teachers' representational fluency in addition to teachers' interpretation of student produced diagrams.

Learning and Teaching Geometry (LTG) PD
The goal of LTG was not only to improve teachers' conceptual content knowledge and increase their ability to engage students in mathematical practices but to also increase students' conceptual understanding of transformations-based geometry.

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