

CONNECTING PROFESSIONAL LEARNING DESIGN FEATURES TO TEACHER LEARNING: A LONGITUDINAL CASE STUDY

K. Koellner¹, N. Placa², N. Seago³

¹Arizona State University (UNITED STATES)

²Hunter College (UNITED STATES)

³WestED (UNITED STATES)

Abstract

This paper examines a professional learning (PL) context to understand what one teacher took up and learned and how this impacted her classroom instruction five years after participating in a specified professional learning (PL) program. Understanding teachers' perceptions about specific design features of a program that they believe impacted their learning brings an important new voice to PL literature. Findings show that the teacher's learning of targeted content and pedagogical strategies was consonant with the PL program's goals and intentions. We highlight five assertions that connect PL design features to teacher learning in four categories - content, pedagogy, resources, and collaboration. Our study provides more granular evidence about the design elements of high-quality PL and contributes new understandings about the connections between PL design features and teacher uptake related to the following: aligned beliefs about teaching and learning, a knowledgeable facilitator, bounded routines, representations, and a community of learners to anchor learning from PL. This study shines light on the necessity of studying teacher learning from PL over time in an intentional and in-depth manner, as it takes time for teachers to incorporate new ideas into their teaching practice and make observable changes. More research is needed to continue the study of how and why PL design elements impact teachers' experiences for corroboration and extending of assertions and theories about teacher professional learning.

Keywords: Mathematics education, mathematics professional development, teacher learning, professional learning.

1 INTRODUCTION

Research has identified equitable mathematical practices that enable children to engage in rich mathematics. However, large scale or quasi experimental research on designing effective professional learning¹ (PL) that leads teachers to implement recommended practices show mixed results; only some PL models demonstrate teacher learning and student achievement (Hill et al., 2020). It is unclear why the enacted PL models have produced such widely disparate results and in-depth qualitative analyses may provide a more nuanced understanding of teacher learning over time, not necessarily to replace large scale studies but rather to complement quantitative findings, and in turn inform PL design. Moreover, shifting to new instructional strategies is difficult as the uptake of new ideas from PL necessitates unlearning of old ways of thinking and changes are typically slow, uneven, and unfold gradually over time (Kennedy, 2016), and thus a longitudinal case study can provide a more comprehensive picture of teaching learning and uptake.

This paper examines one PL context to understand what one teacher learned and how this impacted her classroom instruction five years after participating in the PL program, using an instrumental case study approach. Understanding teachers' perceptions about specific design features of a program that they believe impacted their learning brings an important new voice to PL literature. Taking a closer look at how teachers interpret their PL experiences – including what they remember, what knowledge they believe they gained, and what intentional changes they made to their classroom practice – may shed light on some of the mixed results from past studies. Deep qualitative investigations can offer critical insights into the specific ways that PL impacts learning. Ultimately these insights can help the field better

¹ Professional learning and professional development are intended as synonymous terms in this paper. We use professional learning in the context of the literature where it is now the preferred terminology. However, we use professional development throughout the methodology and findings sections of this paper as this term is embedded in the context of our study, Learning and Teaching Geometry Professional Development (LTG PD).

account for the ties between PL features and teacher uptake and highlight the role of qualitative research methodologies.

Theoretical Framework

Situative theorists define learning as changes in participation in socially organized activity (Greeno et al., 1996). They consider the acquisition and use of knowledge as aspects of an individual's participation in social practices. With respect to professional learning, situative theorists focus on the importance of creating opportunities for teachers to work together on improving their practice and locating these opportunities in the everyday practice of teaching. A situative perspective suggests that groups of teachers who take part in different PL workshops with different facilitators situated within diverse educational contexts might have very different learning opportunities and experiences.

PL Design Features that Promote Teacher Learning

Studies conducted over the past two decades have yielded several design features that play an important role in supporting teacher learning and are most likely to impact student outcomes in general and in mathematics education specifically. These features include active/practice-based learning, access to models of effective practice, collaboration, coherence, content area specificity, expert facilitation/coaching, and sustained duration (Darling-Hammond et al., 2017). In a recent detailed review of the literature, Hill and Papay (2022) identified several characteristics of effective PL design relating to PL format and focus. PL format included the importance of collaboration, coaching, and follow up sessions with teachers. In terms of focus, they note the importance of a focus on pedagogy, resources to support concept development and the importance of collaborations and community.

Examining PL at an even more fine-grained level, Horn & Garner (2022) developed a set of eight conjectures about teacher learning of ambitious and equitable mathematics instruction, and the features of PL that directly support such learning. They explain that PL activities should: 1. address teachers' existing concepts about and practices for teaching; 2. align with teachers' personal goals for their learning; 3. draw on knowledge of accomplished teaching; 4. respond to issues that come up in teachers' ongoing instruction; 5. provide adequate and timely feedback on teachers' attempts to improve their instructional practice to support their ongoing efforts; 6. provide teachers with a community of like-minded colleagues to learn with and garner support from as they work through the challenges inevitable in transformative learning; 7. provide teachers with rich images of their own classroom teaching; and 8. respect teachers' autonomy, agency, and experiences as sense makers by taking a stance of co-inquiry into instructional practice and foster interpretive dialogue (p. 86). They designed an adaptive PL model that incorporated these conjectures and then studied teachers' participation in and learning from the model over a three-year period. Based on a qualitative investigation using case studies to track teachers' perceptions of their learning and their instructional shifts over time, the researchers validated and provided varying degrees of concrete evidence for each of the eight conjectures. Our project² contributes to this growing literature as it focuses on both adaptive and specified models of PL. The case presented here relates to a specified model of PL, and we highlight findings about teacher uptake five years after the original PL was conducted.

2 METHODOLOGY

Case Study of Brianna

This paper focuses on Brianna, a teacher who had taken part in the LTG PD Efficacy study five years earlier. Her initial survey responses placed her in the "high uptake" category. Brianna connected her learning and growth as a teacher to specific design features of the LTG PD, indicating that she found certain elements of the PD to be especially memorable and impactful: the LTG materials, learning new mathematics teaching strategies, and collaborating with math teacher peers. Brianna offered insightful reflections on the rationale behind her uptake, including her residual learning and how that impacted her instructional practice over time.

Brianna serves as an "instrumental" case (Stake, 1995). Instrumental cases allow for deep investigation into one individual's experiences that can provide insight into a puzzlement worthy of exploration. In this case, Brianna shows evidence of significant growth over time, and she offers an important perspective on the components of the LTG PD to which she personally attributes to her learning. Brianna chose to participate in the LTG PD Efficacy study because she had moved to teaching middle school mathematics

² This work is funded by the National Science Foundation grant #1813439.

at that time from being an elementary generalist teacher. She was interested in learning content and teaching strategies for transformations-based geometry, and completed all five days of the summer PL and one of the four PL sessions over the academic year. Throughout the current research project, Brianna taught 6th and 8th grade mathematics in a relatively affluent suburban neighborhood in the Western US.

Data Collection and Analysis

For Brianna's case study analysis, we triangulated videotapes, clips selected for stimulated recall, semi structured interviews, and survey data. We collected six videotapes of Brianna's classroom teaching and conducted four semi structured interviews throughout 2021. Since Brianna participated in the LTG PD from Summer 2016 to Spring 2017, data collection timeline is four to five years after she attended the workshops. The first half of each interview was focused on Brianna's current teaching practices, beliefs, and goals, while the second half of the interview was a stimulated recall using video clips that Brianna had selected as evidence of content, pedagogy, resources, and collaboration that she believed were related to the LTG PD. All interviews and video clips were transcribed. The interview data was coded using *a priori* as well as emergent codes related to content, pedagogy and resources that helped us to understand more deeply Brianna's uptake from professional learning and whether she attributed her learning to an aspect or design feature of the LTG PD. We clustered the codes and developed assertions that were statements connecting Brianna's stated experiences and learning from the LTG PD to the design features of the program. In the next section, we describe each of these assertions with evidence from the data.

3 RESULTS

The data led us to develop five assertions. We now highlight the assertions individually, drawing on brief quotes from Brianna to explain some of the meaning behind each assertion and the relationship to the LTG PD. We use excerpts from the interviews, videos, and surveys to "hear her voice" throughout the paper. Additionally, we collected artifacts of practice including student work and photos of her classroom which provided further triangulation. We recognize that the data excerpts included here are brief and will expand on our evidence during our poster session and discussion and in an upcoming publication.

3.1 TEACHER LEARNING UPTAKE AND ASSERTIONS RELATED TO PL DESIGN

3.1.1 Assertion One. Aligned beliefs about mathematical teaching and learning support teacher learning.

Brianna's beliefs about how students learn mathematics aligned with the PL's approach and this supported her classroom uptake. Drawing on a situative theoretical perspective, the LTG PL was designed on the ideas that knowledge is situated within teachers' classrooms, learning is socially constructed, and that individuals can develop an understanding of similarity and transformations-based geometry from many different vantage points. In her own words: "One shift that is noticeable in my [teaching] practice is that I try to use problems where there's an entry point for all kids. Like the low floor, high ceiling problems we discussed in PL. And so, there's a way for everyone to be able to participate and have access to the problems, and the expectation is that everyone participates."

3.1.2 Assertion Two. A relatable and knowledgeable facilitator creates an authentic community for teacher learning.

The LTG PL program facilitator Hannah had helped create some of the PL tasks; she was also the teacher in some of the video clips shown to PL participants. Thus, the videos of Hannah teaching middle schoolers transformations-based geometry were authentic clips that offered a window into ambitious instruction. Brianna commented in a survey, "I always like when presenters model best practices and moves."

3.1.3 Assertion Three. Short, bounded routines support teacher learning of new pedagogical strategies.

The LTG PL incorporated a variety of smaller bounded routines consistently throughout the workshops. In particular, the PL introduced these routines through two resources: Geometric Transformations Workouts (GTWs) and the Geometric Transformations Field Guide. These two resources promoted the

use of instructional routines that strongly resonated with Brianna and led to her uptake in the classroom. She shared: “One thing I love and use all the time are warmups (GTWs). I like to use them with my students so they can ‘argue’ or debate their thinking using multiple choice problems with their peers and I can encourage students to use Accountable Talk procedures. And so, one of the things I learned from the PL is just to be more purposeful about what my introductory tasks are. So, this idea of having a structured warmup that they do every day, that they know to expect every day.”

3.1.4 Assertion Four. *Mathematical representations anchor teacher learning.*

Utilizing mathematical representations provides learners the opportunity to deeply conceptualize and connect their content understandings. The LTG PL highlighted the use of mathematical representations as an anchor for the learning of rigorous content, specifically geometric transformations, congruence, and similarity. What is significant is that Brianna not only remembered the use of representations in the LTG PL, she also incorporated different content specific representations in topics she was currently teaching. As she shared in her stimulated recall interview regarding one of her video-taped lessons, “One of the things that was important to the PL was the use of models. And while a lot of those models were on coordinate grids and graphing and shapes and scaling and what not, these right here, they were number lines that we were used to be able to go from negative to positive numbers.”

3.1.5 Assertion Five. *Focused collaboration supports teacher learning.*

Having collaborative colleagues both within her school and across schools and district(s) supported Brianna’s learning of ambitious practices in a classroom context. Brianna had attended the PL with another teacher Paul from her school and commented in the survey: “I was very lucky to be able to take the course with one of my teaching partners which allowed us to collaborate after the fact.” Brianna also discussed the importance of working with teachers from her district and another nearby district during the LTG PL.

4 CONCLUSIONS

Brianna is a case of a teacher who is highly motivated to improve her practice and who eagerly responds to opportunities to participate in ongoing professional learning opportunities. She had a positive experience taking part in the LTG PD and we have strong evidence of active uptake and learning five years post PL. Many of our findings are consistent with relevant research, provide more granular evidence about the design elements of high-quality specified PL, and contribute new understandings from a teacher’s perspective about how the PL design and enactment impacted her experience. More specifically, the case study of Brianna revealed the importance of having a community of learners, aligned beliefs about teaching and learning, a knowledgeable facilitator, small, bounded routines, and the use of representations to anchor learning from PL.

An important consideration related to these findings is the highly specified nature of the LTG PD. Brianna attributed her learning to aspects of content, pedagogy and resources from the PL that reflect the stated goals and intentions of the program. More research is needed to better understand the extent to which uptake may or may not be related to a PL program’s specified or adaptive design. The author team is closely examining other case study teachers from PL programs that are located on different points along the specified-adaptive continuum (Koellner & Jacobs, 2015), and we hypothesize that certain design elements may be more or less critical for teacher learning depending where they fall on this continuum.

REFERENCES

- [1] Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/Effective_Teacher_Professional_Development_REPORT.pdf
- [2] Greeno, J., Collins, A., & Resnick, L. (1996). Cognition and learning. In D. Berliner & R. Calfee (Eds.), *Handbook of educational psychology* (pp. 15-46). MacMillan.
- [3] Hill, H. C., & Papay, J. P. (2022). *Building better PL: How to strengthen teacher learning*. The Research Partnership for Professional Learning.
- [4] Hill, L., Gonzalez, K. E., & Pollard, C. (2020). Professional development that improves STEM outcomes. *Phi Delta Kappan*, 101(5), 50–56. <https://doi.org/10.1177/0031721720903829>

- [5] Horn, I. & Garner, B. (2022). *Teacher learning of ambitious and equitable mathematics instruction: a sociocultural approach*. Routledge. <https://doi.org/10.4324/9781003182214>
- [6] Kennedy, M. M. (2016). How does professional development improve teaching? *Review of educational research*, 86(4), 945-980.
- [7] Koellner, K. & Jacobs, J. (2015). Distinguishing models of professional development: The case of an adaptive model's impact on teachers' knowledge, instruction, and student achievement. *Journal of Teacher Education*, 66(1), 51–67. <https://doi.org/10.1177/0022487114549599>