# Bridging the practice-to-research chasm for in-service STEM teachers

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## Introduction

Educational reform curricula encourage STEM teachers to incorporate critical thinking strategies into their lessons while introducing elements of science, technology, engineering, and mathematics (STEM). In Quebec, Canada, this includes proposing solutions to real-world problems, research, open-ended experiments, and engagement with interdisciplinary projects (Ministère de l'Éducation du Loisir et du Sport (MELS), 2007). Regrettably, there has been a dearth of professional support for in-service teachers to develop these sophisticated teaching skills, and thus their enactment remains problematic (Potvin & Dionne, 2007). High-quality collaborative professional development (PD) such as a professional learning community (PLC) can facilitate expanding teachers' epistemological and pedagogical knowledge (Darling-Hammond et al., 2017; Hargreaves, 2019; Kruse & Johnson, 2017; Schmidt & Fulton, 2015), which is essential if teachers are to develop these practices.

This presentation examines *how* in-service science and mathematics teachers collaborate to co-construct and enact inquiry-based pedagogies. This study explores two research questions. The first is "what were the tensions that teachers experienced as they struggled to develop inquiry teaching practices? The second question is, "how did teachers' epistemological beliefs about teaching shift as they engaged, shared, and critically examined their professional practice in a PLC? Understanding how teachers work in a collaborative PD model can help scholars and policymakers understand professional learning dynamics. This work extends current research on how STEM high school teachers support each other in a PLC.

## Methodology and Methods

This study employed ethnographic methodologies. Eight mathematics and science high school teachers participated in an eight-month PLC that focused on developing inquiry-based teaching strategies. The data corpus includes 16 semi-structured pre- and post-PLC interviews and monthly meetings that were video-recorded and transcribed, participant reflexive journals, and researcher field notes. Salient concepts were developed into themes using the constant comparative method (Braun & Clarke, 2006). Themes were analyzed and interpreted using an inductive thematic approach to theorize patterns relating to the research questions (Braun & Clarke, 2006).

During meetings, teachers discussed inquiry-based teaching practices following a video club format in which teachers discussed and analyzed how they enacted inquiry-based pedagogies (Borko et al., 2008; Horn & Little, 2010; van Es et al., 2014). Teachers shared two exemplars of their video-recorded classroom practices, and collaboratively analyzed their professional videos.

## Findings

Two central themes emerged from the data: teachers' struggles to enact inquiry-based pedagogies and the importance of supportive structures during an *in situ* learning experience. During initial interviews, teachers indicated they were not incorporating inquiry-based pedagogies in their lessons. Novice teachers were reluctant to experiment with inquiry-based pedagogies learned in university methods courses. However, after eight months of collaborative learning, novice teachers began to incorporate inquiry-based pedagogies into their lessons, as evidenced in their teaching

videos. The first interviews with experienced teachers suggested they were neophytes when it came to inquiry-based practices, which was not surprising, given the lack of PD during the reform implementation years. They made significant strides forward with questioning skills – pressing students, eliciting student thinking, and using a driving question to anchor lessons.

The findings illuminate how the PLC helped experienced teachers visualize inquiry-based pedagogies by "watching the videos [of novice teachers] and becoming more conscious." Second, the novice teachers overcame their insecurities and developed confidence through encouragement, validation, and support from their experienced colleagues.

### *Conclusions*
In conclusion, the PLC experience initiated a shift in professional practices as teachers began transitioning to inquiry-based practitioners. Novice teachers shared their struggles with inquiry, worried that there would be less class control, reduced teaching time and the stress of following institutional norms. However, these narratives shifted as the experienced colleagues mitigated their insecurities, classroom management problems and lesson planning issues. Simultaneously, experienced teachers developed an understanding of inquiry-based teaching by watching and discussing the novice teachers' video lessons. There was a dynamic weaving and intermingling of roles within the STEM teacher learning community.

The data raises relevant concerns. First, educators need to understand the disconnect between university theory and the reality of on-the-job teaching. The novice teachers could not enact inquiry-based practices without support. Instead, they had lapsed to traditional teaching, informed by the *apprenticeship of observation* (Lortie, 2002) - the years spent observing their classroom teachers. This study extends the current literature on PLCs, suggesting that a PLC model that intentionally includes novice and experienced teachers can help teachers co-create new ways of teaching.

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