

Countering Post-Truth Perceptions: Micro-credentialing Urban Math and Science Teachers' Action Research to Improve Student Learning

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Context

- The CCSSM and NGSS standards frameworks represent significant shifts in what students are expected to learn and recast demands on teachers' content knowledge, pedagogical content knowledge, and knowledge for teaching (Goertz, Floden & O'Day, 1995; Sykes & Plastrik, 1993; and Ball, Thames, & Phelps, 2008).
- General public believes “anyone can teach if they know a particular subject and that it is not really necessary to first learn about curriculum, classroom management and instruction” (Strauss, 2017).
- Legislation allows teachers to be hired with no formal training (e.g., Arizona, Louisiana, and Wisconsin) and the use of industry-sponsored, ‘teacher-proof’ curriculum (Wertz, 2017; Gunter, Hall & Apple, 2017).
- This context is particularly problematic in large, high poverty, urban school districts where accountability frameworks require documented gains in student learning and teacher professional development is limited and inconsistent (Avalos, 2011; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

Research Framework

Research Question: How might action research and micro-credentialing in the knowledge domains for teaching document development of a teacher's professional practice?

Three theoretical lenses:

- Teacher learning as a situated, distributed, and social activity (Borko, 2004; Lave & Wenger, 1991; Lieberman & Miller, 2008) that stimulates an ever-evolving professional practice (Bales & Saffold, 2011; Dall'Alba & Sandburg 2006, Bell & Gilbert, 1996) .
- Action research, as a professional learning action strategy, enhances teachers' knowledge, improves educational practice, and contributes to the knowledge base (Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2010) .
- A system of micro-credentials motivates participation (Gibson, Ostashewski, Flintoff, Grant & Knight, 2013), allows participants to make individualized decisions about what to learn, provides opportunities to customize content specific to their needs and local work (Kinshuk, Graf and Yang, 2010), and makes professional knowledge visible to the public.

Model Design and Participants

Professional Development Model: Action research-based micro-credentials to develop expertise in the knowledge domains for teaching (Ball, Thames, & Phelps, 2008; Windschitl, Thompson, Braaten, & Stroupe, 2012).

- **Common Structure of Micro-credentials:**
 - An opening activity orients teachers to the construct and links to a specific mathematics or science task.
 - Discussion of teachers' pedagogical experience with the topic.
 - Reading of selected research-based texts.
 - Development of a research question
 - Design and implementation of action research project.
 - Collection and analysis of student artifacts.
 - Response(s) to research question.
 - Reflections on teacher and student learning and next steps.

Participants: 24 high school mathematics and science teachers with master's degrees primarily in Curriculum and Instruction.

Data Generation and Analysis

Data Generation

Survey responses, video observation of teachers teaching, year-end focus groups, and a document analysis of their action research projects.

Analysis of Data

- Identified essential features related to project goals and theoretical underpinnings.
- First cycle coding was deductive and structural (Saldana, 2016).
- Microanalysis of the language within each artifact.
- Compared and analyzed coded sections within each data set, which yielded similar language patterns (Clark & Creswell, 2009; Coffey & Atkinson, 1996).
- Second cycle coding noted any interrelationships and patterns among analyzed segments (Wolcott, 1994).

Three Themes Emerged then Resituated in Data

- How teachers understand the knowledge domains for teaching.
- How they make sense of and take up new learning in their professional practice.
- Tighter sequence of claims, evidence, and reasoning in action research projects.

Three Findings + New Instrument

F #1. Teachers built a personalized learning path into the knowledge domains for teaching.

- *Teacher A, whose first action research project explored the specialized content knowledge domain, noted, “I would like to get to the point with our department where we have a common rubric for looking at CER (Claim-Evidence-Reasoning) as this is an important component of all science”.*
- *Others worked in different domains. Teacher H investigated her use of online tools and asked, “Will online interactive Gizmos® simulations from ExploreLearning® that cover the topics of DNA replication, transcription, and translation have a significant impact on student achievement in a 9th grade Biology class”?*
- *Some teachers engaged in badges with a broader, curricular focus. Teacher M shared, “In our department, we need to align curriculum vertically and try to collaborate better for a cohesive unit”.*

Developed Chronicles of Learning And Development Episodes (CLADE) for teachers to mark/chart/plan learning.

1. Identify each badge completed and three key concepts learned.
2. Provide an example of student learning that depicted explicit connections between teacher learning and classroom practice.
3. Link the knowledge domain of each badge completed – what they learned – to the theoretical constructs of each domain, which provided a three-dimensional view of their efforts (i.e., how many domains and how many in each).

Teacher K, "It is now clearer to me that my Year II work centered around my knowledge of content and teaching and content and students. This is interesting since I started the year thinking I needed new tasks and activities to help students learn in a different way than we had been. I would have thought that would have lead more to a shift in my curriculum and content but instead it took me more towards understanding my students, how they learn math, and what I am doing as the teacher to change and improve that".

4. Reflect on totality of their learning over the year, offer evidence of growth/changes in their classroom practice, generate goals and badges for following year.

Three Findings + New Instrument

F #2. The Importance of teacher voice in their learning

Self-selection of badges and the individualized nature of action research projects was essential in personalizing what each teacher wanted or needed to learn.

“It was important that I pick which badge I wanted to complete. It had to be a badge where I could collect data and reflect on something I actually workshopped in the classroom” (Teacher N).

One teacher proudly described the personalized integration of new learning and knowledge into his Year III projected plan for badges:

I will continue to focus on the pedagogy of teaching. The work I will be doing around the five practices for student discourse should only help strengthen the work done already with modeling, tasks selection, and productive struggle. Improving the discourse aspect of each lesson will hopefully enrich the already more in meaningful lessons I have been implementing. (Teacher C)

Three Findings + New Instrument

F. #3. Micro-credentialed action research is a mechanism to develop teachers' practice.

Three goals framed the action research-based micro-credentials:

1. Recognize that classroom teaching and learning was a valid platform from which to base their inquiry and offered a legitimate source of data.
2. Build a shared conception of well-grounded action research.
3. Move beyond overly broad and inappropriate causal constructions in their research design.

We examined each micro-credentialed action research project for three, specific attributes:

- Were their research questions causal or non-causal in design?
- Were their research questions broad or specific?
- Were constructs in the study defined clearly or unclearly?

Teachers honed their research questions and skills each time they took up a new micro-credential, which afforded a more focused look at teaching and learning in their classroom. Table 1 illustrates this improvement.

Table 1. *Changes in teachers' ability to write less causal and more specific research questions with clearly defined constructs.*

Badges from Year # Quarter #	Causal	Not causal	Broad	Specific	Unclear Constructs	Clear Constructs	No question
Y1Q1	12	6	14	4	3	15	6
Y1Q2	0	0	0	0	0	0	24 ¹
Y1Q3	14	10	21	3	5	19	0
Y1Q4	1	0	1	0	0	1	23
Y2Q1	2	8	8	2	2	8	1 ²
Y2Q2	8	16	18	6	9	15	0
Y2Q3	5	13	8	10	7	11	
Y2Q4	3	15	5	13	7	11	

¹ No research question due to the nature of the badge.

² 13 NQs due to badge design

Significance

This research highlights the importance of teacher in first identifying a growth area from within the knowledge domains for teaching and how they then take up that new learning in their classroom practice. Studying their changing practice through action research allows teachers to mark and chart their profession growth in each knowledge domain. Documenting that learning with a micro-credential badge validates teachers' professional work. It also makes this growth visible to the public. In doing so, they provide multimodal narratives of their learning with democratized evidence and counter post-truth perceptions about their role in helping children learn.

As Teacher J reported: "Badge work, combined with other readings, really moved my focus from strictly content and skill lessons to how we solve mathematical problems. The ...badge selections helped me create lessons that transcend content to how we do mathematics and how to be a good mathematician".