

Expanding Outcomes: Exploring Varied Forms of Teacher Learning in an Online Professional Development Experience

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Abstract: The field of teacher professional development has long been characterized by tensions surrounding the articulation and measurement of learning outcomes. These tensions are amplified as new technologies are used to provide online learning experiences that serve larger and more varied audiences. This paper uses a case study of the Creative Computing Online Workshop—a large-scale online learning experience for teachers—to explore the variety and breadth of teacher learning outcomes that can be considered meaningful. Through in-depth interviews with teacher participants we find that teachers make use of their learning in four distinct, but related, ways: engagement with new ideas, varied enactment in practice, rethinking of role and identity, and changing interaction with the world outside their classroom. We conclude by considering the implications of this expanded framework of teacher learning for future design and evaluation of professional development.

Keywords: teacher learning, professional development, learning outcomes, online learning, MOOCs

Introduction

Research about teacher learning has long asserted the importance of professional development but has often been frustrated in attempts to demonstrate the impact and outcomes of professional development experiences (Borko, 2004). This ongoing frustration has given rise to increasingly refined and narrow measures of the effectiveness of professional development, obfuscating the complexity and variety of potential learning outcomes—often with disappointing results (Hill, Beisiegel, & Jacob, 2013). While acknowledging the importance of research that seeks to demonstrate the value of professional development experiences in clear and quantifiable outcomes, we are concerned about what is overlooked by this approach. We therefore ask in this paper: What can we learn about the value of professional development by broadening both our definition of legitimate or substantive outcomes and the way in which we seek to uncover such outcomes in teacher learning?

To investigate this question, we present a case study of the Creative Computing Online Workshop (CCOW), an online professional learning experience focused on supporting teachers working with the Scratch programming environment in the classroom. We use in-depth, qualitative interviews to explore the outcomes from CCOW that teachers considered meaningful for their learning and teaching and compare these with outcomes emphasized by more traditional evaluations of professional development. Drawing on these findings, we ask how a broadened conception of outcomes might influence both the *evaluation* and *design* of professional learning experiences for teachers. We are particularly concerned with implications for the field of online learning, where new platforms such as Massive Open Online Courses (MOOCs) serve a large number of teachers with diverse backgrounds, needs, and interests.

We present our study of professional development outcomes from CCOW in four parts. First, we review the literature on professional development to identify both the traditional ways in which the outcomes of PD have been valued, understood, and measured and the ways in which these traditional approaches have been critiqued. We then describe the context of our research, CCOW itself, and our methodological approach to understanding teachers' own conceptions of their learning outcomes. In the findings, we highlight four types of teacher learning outcomes from CCOW. We conclude by considering these findings in light of relevant literature on teacher learning outcomes, as well as implications for further research and design of professional development.

Literature review

Over the past two decades, a number of foundational observational studies have cohered around a set of professional development characteristics associated with positive valuations by teachers (Garet, Porter, Desimone, Birman, & Yoon, 2001), increased self-reported use of particular instructional practices (Desimone et al., 2002), and enhanced teacher knowledge (Penuel, Fishman, Yamaguchi, & Gallagher, 2007). The characteristics noted by these studies include content focus, opportunities for active learning, and coherence with other learning activities (Garet et al., 2001). Underlying this consensus is a logic model, wherein professional development with

these characteristics results in changes in teachers' knowledge and beliefs, which in turn changes their practices and improves student outcomes (Desimone, 2009; Supovitz, 2001). Nevertheless, efforts to scale up professional development models that emphasize these characteristics have repeatedly been unable to demonstrate positive changes in student outcomes (e.g., Garet et al., 2011).

Broadly, there have been two categories of response by researchers to this problem. The first has been to tighten the alignment between various parts of this logic model. Wayne, Yoon, Zhu, Cronen, & Garet (2008) and Desimone (2009) each set a research agenda for the measurement of effective PD that focused on capturing the causal mechanisms between PD, teacher actions, and student learning. Following in this trend, a number of recent studies have measured the impact of professional development by evaluating teachers' adoption of practices based on a fairly narrow checklist of behaviors in specific instructional settings (e.g., Polly, 2011; Walker et al., 2011). Other similar approaches have focused on different aspects of the causal chain at different points of the research design (e.g., Hill, Beisiegel, & Jacob, 2013). While these kinds of research designs and questions represent important attempts to better understand the mechanisms through which professional development results in changes in teaching and learning, we are concerned about what may be lost when researchers focus exclusively on evaluation through these frameworks—and as a result, design professional development experiences with very specific outcome measures in mind.

Accordingly, we turn to the second category of response, which more openly embraces the complexity of both teacher and student learning processes. Some work has questioned the over-reliance on student achievement metrics in the evaluation of professional development (Cochran-Smith et al., 2012; Shulman, 1986). Others have questioned the time frame in which the impacts of a learning experience are considered, arguing that some effects of PD may only become evident after longer periods of time (Supovitz, 2001; Wayne et al., 2008), that sustainability itself is an important and valuable measure (Coburn, 2003; Zehetmeier & Krainer, 2011), or further that there are more indirect ways that teachers can internalize and enact new learning over time (Kennedy, 2005; Muijs, Day, Harris, & Lindsay, 2004).

Other work has continued this embrace of complexity by focusing on the socio-cultural and contextual nature of teacher learning and practice. Considering teacher knowledge less as abstract principles, and more as being situated in their local context (Putnam & Borko, 2000) raises questions about our ability to effectively measure what teachers across a variety of contexts have learned from a professional development experience. A multiplicity of factors influence how teachers make choices about what aspects of learning to implement in practice, in light of the particulars of their localized student needs (Ball & Cohen, 1999; Cuban, 2001; Guskey, 2002). These understandings have led to research that foregrounds teacher learning as embedded in organizations and communities, thus questioning individualized measures of learning (Johnson, 2015; Schlager & Fusco, 2003).

The emergence of MOOCs and other forms of online learning platforms as prominent sites of teacher learning has furthered the need to rethink the metrics we use to evaluate learning experiences. An ongoing tension within the field of research on MOOCs is how to define assessment (Haggard et al., 2013). Many MOOC designers and researchers challenge the application of traditional metrics to understand the learning of MOOC participants due to both the diverse and often unique intentions learners bring to these platforms and avenues for asynchronous and individualized engagement (e.g., DeBoer, Ho, Stump, & Breslow, 2014). Part of the purpose of the present study is to more fully understand the results of the interaction between the variability of learner intention and participation and the variability of what counts as meaningful learning.

Methods

This study builds on these approaches in seeking to broaden the conception of meaningful outcomes for teacher learning experiences. We use the Creative Computing Online Workshop (CCOW) as a case study to explore a central question: What outcomes do teachers identify as important to their professional learning experiences? By framing our central research question in this way, we are intentionally *not* applying a pre-determined definition of success or effectiveness, and instead using an in-depth qualitative interview approach to enable teachers to highlight which outcomes were most meaningful and valuable to them (Kvale, 1996). Rather than presenting a checklist of outcomes to be applied to future learning experiences, the findings from this case-study model are presented with the goal of illuminating possible alternative places to look in the hopes of understanding the range of ways that teacher learning can manifest (Shulman, 1983).

Research context

The Creative Computing Online Workshop (CCOW) was a six-week online course designed for teachers to learn about Scratch (<http://scratch.mit.edu>). Scratch is a free graphical programming environment that enables young people to create their own interactive games, stories, animations, and art—and then share their creations with others in an online community. CCOW was hosted from June 3 to July 12, 2013, and had international enrollment

of ~2,100 people, with 51% indicating that they intended to participate beyond “just browsing”. Both Scratch and CCOW were inspired by constructionist approaches to learning, which emphasize learning through designing, personalizing, sharing, and reflecting (Brennan, 2015). The design of CCOW reflected these principles as participants created their own projects with the Scratch programming language, shared and remixed one another’s projects, connected through the Scratch online platform and CCOW online forums, designed and pursued a final project motivated by their interests (ranging from curriculum design to hosting workshops to exploring forms of expression), and maintained online design journals that served as a record of and reflection on their participation throughout the workshop. Over the six weeks of the workshop, participants watched workshop videos 24,000 times, created 4,700 Scratch projects, and wrote 5,000 discussion posts in the course forums, Twitter, and via Google+. The teachers described in the present study represent a core group of participants whose engagement and activity in the workshop far surpasses the “average experience” indicated by such broad metrics, as is typical for MOOCs (DeBoer et al., 2014).

Data collection

The data analyzed here were collected as part of a larger study investigating what teachers found meaningful about their learning experience in CCOW (Brennan, Blum-Smith, & Yurkofsky, 2015). To obtain a sample of teacher participants who had completed the course, we identified 57 full-time teachers out of the 127 participants who had completed an exit survey and expressed a willingness to be interviewed. We intentionally sampled this group for diversity across curricular areas, ages taught, country of origin, programming and Scratch-specific experience, and extent of participation in CCOW. Of the 36 teachers that we contacted, 15 agreed to be interviewed. The majority of teachers in our final sample taught technology, lived in the United States, and had at least some programming experience. Six teachers in our sample worked in primary schools and the other nine in secondary schools. Eleven identified as “experienced” or “very experienced” with Scratch.

To investigate the question of what teachers took away from their learning experience in CCOW, we conducted semi-structured interviews with each of the 15 teachers. Interviews lasted around 90 minutes and were conducted in-person or over Skype or Google Hangouts by one of the authors. Interviews were audio recorded, transcribed by a third party service, and then checked for accuracy by one or more of the authors. We developed and followed an interview protocol structured into four major sections: (1) teachers’ demographic and professional information, (2) descriptions of meaningful learning experiences from the past, (3) discussion about which aspects of CCOW teachers found more or less meaningful, and (4) whether (and how) teachers made meaning of their learning in CCOW following course completion. The analysis and findings discussed below focus on this final part of the interview.

Our approach to data collection had three key limitations. First, our sample was biased towards US-based technology teachers who had prior experience with Scratch and programming. While this sampling certainly diminished our ability to understand the breadth and diversity of learner experience in the course, it should also be noted that there was individual and experiential variety amongst those we interviewed in terms of the context of their work and ways they made use of their learning. Second, because they were people who completed the course and elected to fill out an exit survey, it is also likely that the sample was skewed towards participants who had had positive experiences in the course. However, all the teachers with whom we spoke felt comfortable noting aspects of the course that had little or no influence on their practice. Finally, given the variety of ways, both formal and informal, through which teachers gain new knowledge, ideas, and practices, it can be difficult to precisely identify the experiences that resulted in specific pieces of new learning. We were unable to observe teachers’ practices either before or after their experience in CCOW and it is certainly possible that learning attributed to CCOW was, in fact, from another source. While the year that elapsed between CCOW participation and our interviews exacerbated this possibility, it also enabled us to see the ways that teachers reflected on their learning over time.

Data analysis

We began our analysis with line-by-line emic coding of the interviews and organized the emic codes thematically (Boyatzis, 1998). We considered relevant language in which teachers discussed their classroom practices in the time following CCOW, made reference to thinking or action that differed after the course, and reflected upon their approach to teaching and learning in the context of their course experiences. Following this initial coding, we attempted to articulate themes that would capture what teachers said they learned from their experiences in CCOW. Our review of the literature suggested that changes in teacher knowledge, skills, practices, and beliefs might be categories through which to consider the outcomes of teacher learning. As we analyzed teacher interviews, we saw these categories reflected but were also struck by unexpected outcomes such as ways that participants thought more broadly about the process of learning and their own role as a teacher. We searched

purposefully for examples of learning that did not match these initial findings, and returned repeatedly to the raw data to ensure that our emerging conceptualizations remained grounded (Maxwell, 2010). We used an iterative process of visual mapping and memoing (Luttrell, 2010) to relate these themes to one another before developing an overall framework that moved through four categories of learning outcomes: teacher and idea, teacher and practice, teacher and self, and teacher and world.

Findings

The following section will explore CCOW learning outcomes that teachers reported as meaningful. In *teacher and idea*, we look at how teachers took away particular facts, skills, and knowledge from the course. In *teacher and practice*, we consider the different ways that teachers applied those ideas to their own classrooms and students. In *teacher and self*, we explore how engagement with these ideas and practices led to changes in participants' thinking about how they approached teaching and learning in general. In *teacher and world*, we discuss how learning outcomes involved changing conceptions of learning and work beyond an individual teacher or classroom.

Teacher and idea

When reflecting on the impact of CCOW, many teachers discussed specific knowledge and skills that they gained from the learning experience. Although CCOW was designed as a creative and constructionist learning experience, one particular purpose of the workshop was to support teachers in building skills and knowledge around using and teaching Scratch in the classroom. Indeed, most of the teachers we spoke to expressed that they had participated in the course in order to gain this knowledge, particularly because of the recent release of Scratch 2.0. Justin, a middle-school digital art and design teacher, was interested in learning more skills about how to teach Scratch, and saw the workshop as a resource in his self-directed skill development. He reflected, "I think teaching-wise, I got more comfortable with different uses of screencasts and video lessons . . . it was like an orientation to Scratch 2.0, where it kind of like forced me to do some of the stuff I might have skipped from time to time." As Justin's description indicates, some of the ideas teachers gained from the course included particular programming tools and activities and ways to use them.

Others noted how engaging with activities in CCOW helped them learn new skills and ways of thinking about programming. Justine, an elementary instructional technology teacher, described how the Debug Its—programming tasks where participants had to fix a program that wasn't working—helped her to "read scripts, think iteratively, how to just decompose or pull things apart." When referring to the ideas that they learned from CCOW, there was considerable variety in how teachers articulated the value of that knowledge. In addition to simply increasing their knowledge base, some teachers focused on how building their own facility with Scratch enabled them to support more complex and in-depth student work with the program.

Teacher and practice

As teachers integrated ideas from the course into their existing practice, the nature of that integration varied, from direct reuse of course activities to changes in underlying approach to teaching. Some course activities—and the ideas embedded in their design—resonated with teachers and, in particular for those who taught Scratch in the classroom, were easily applicable to their own contexts. Aamir, a middle school computer science teacher, described how using "About Me" projects (an activity in CCOW where teachers created a program that introduced themselves to other course participants) allowed students to learn from models while developing a personal vision. Other teachers discussed using Debug Its and remixing activities, as well as showing students the "nuts and bolts" videos that the course designers had made to introduce core concepts and skills.

Beyond directly importing course activities into their classrooms, some teachers adopted less content-specific practices. Prompted by her own experience with keeping a design notebook—a place to record what she was doing during the course and how it was making her think—Sharon, an elementary computer lab manager, began to use more reflection-based activities with students. She designed prompts similar to those that guided her reflections on CCOW in order to help students develop metacognitive capacities and enable her to gain greater insight into their needs. Sharon, like other teachers, related these new practices to shifts in pedagogy, commenting that "I think I did a little too much lecturing . . . it worked better just to let them in there, and play around . . . it was finding that balance, and I think after CCOW, I found a better balance of how much information you give them to start with."

Some of the most interesting ways of turning ideas from the course into changes in practice came from teachers who taught *different* content and were less able to directly apply lessons or activities. For example, Laura, a sixth grade math and science teacher, found the experience with Scratch helpful in resolving an instructional dilemma. In describing the application to math, she reflected, "I could say—oh, use the Wait Block, but I don't. I

say—check and see what could help you . . . There’s just so many connections I think, with the habits of mind, the way that you work through something.”

It is important to stress that many of the teachers we spoke to were unsatisfied with the extent to which they had incorporated lessons from CCOW into their own practice. For some teachers, this was a result of their school’s stricter control over curriculum and pedagogy that discouraged classroom-level experimentation with new approaches. Other teachers expressed that they simply did not yet have the time to invest in substantive changes to their classroom practice, but were still hoping to use upcoming breaks to implement such changes.

Teacher and self

For some teachers, these changes in practice were connected to more fundamental changes in how they thought about what it meant to teach and be a teacher. Raphael, a high school math and physics teacher, already had a clearly articulated constructivist pedagogy, one in which he purposefully structured classroom activities to invite student inquiry and collaboration while minimizing his own role in transmitting knowledge. Yet, he described how meaningful the experience of reflection had been for him during CCOW, and what it meant to him to practice reflection in his own classroom. Noting that reflection had been “completely absent before,” he described his new approach: “I try to walk around the classroom, and I take a lot of notes about the way they’re working, and the way they’re interacting, the way they’re discussing, or not discussing to each other.” For Raphael, reflection had not explicitly been a part of his approach to teaching, but he saw it as valuable toward his goals of deeply engaging with his students’ understanding of content and supporting their exploration.

Many of the teachers that we spoke to highlighted how CCOW supported a shift away from the teacher as locus of authority and knowledge, towards students learning through exploration and collaboration. Laura, who discussed learning how to let students solve problems differently in math, described how she began to see her role as a teacher in science instruction change in the year following CCOW. “From the very beginning this year I just stood back. . . . Whereas last year . . . I would intervene a lot more. . . . Sometimes they need to learn by failure and I didn’t want to let that happen. . . . And it’s funny because this year’s kids are a little more rambunctious than last year’s kids.” Laura mentions changes in her practice, but also relates these changes to a new conception of herself as a teacher, as someone who is not a “hoverer” but feels comfortable standing back and letting students make mistakes. Some teachers emphasized that greater confidence in their programming knowledge and skills allowed them to be more comfortable with letting go of some control and allowing for greater student exploration, despite the increased potential for messiness and uncertainty.

Teacher and world

Some teachers articulated the value of their experiences in CCOW in terms of new or different ways of engaging with the world beyond their individual classrooms. While this theme was less widespread amongst the teachers we spoke with, its power for some speaks to the importance of broadening our conceptions of meaningful professional development outcomes.

CCOW served a legitimating function for some, giving them confidence and knowledge to advocate for creative computing with school administrators. Diane, an elementary director of educational technology, reflected that “the final project helped to clarify in my mind and to be able to validate it and to better be able to present it to my administration,” adding that she was able to use this clearer articulation of the kind of work she wanted to do to leverage the purchase of new computers. This kind of support was especially important given that many of the technology teachers we spoke with were often isolated from general school improvement work.

A number of teachers reported that their experience in CCOW helped them to make better use of the Internet to find ongoing professional support and information relevant to their teaching. As Kelly, a high-school computer studies teacher described, “I think I really learned about the power of the Internet for educators, of how connected we can be. . . . I usually go when I have a need, or I’m looking for something, or I’m going to show it to somebody else.” In this sense, ongoing access to information and peers working through similar endeavors helped teachers in actually implementing some of the instructional practices highlighted in CCOW.

For others, tapping into an online community of educators with similar ambitions and values had additional benefits. Aamir, who was the only technology teacher at a more rural school outside the United States, reflected on the impact of the online community that developed as a result of CCOW.

[The online course and community] also gives you the feeling that even if you are in a small village in the countryside, and any place on earth, you can be part of this huge community. It is very important. It is very important. It’s like you are more connected, you are part. You do exist. Very important. You do exist. You can speak with a lot of teachers in the countryside, I know

them and they feel like they really don't exist. With online courses, even if you are in the countryside, or very isolated, you can be part of a community.

As reflected in many of these experiences, it can be meaningful and powerful for teachers to locate their individual work, thinking, or approach within broader communities. The teachers that we spoke with came into the course with a range of experiences with Scratch, the world of computer science, creative computing, and constructivist approaches to teaching and learning. Some, like Raphael and Aamir, had a strongly developed pedagogical approach that was already aligned with CCOW and could locate that approach within conversations of theory and practice beyond their schools. For others, their CCOW experience helped them to see that the work they were doing, or wanted to be doing, was connected to larger communities. Diane, who noted the value of CCOW in advocating with her administration, reflected on how the course experience opened her up to a world of practice that she hadn't known about, but that deeply resonated with her vision of teaching.

Conclusions and implications

Our study builds on prior research that seeks to understand complex processes of teacher change (Ball & Cohen, 1999; Kennedy, 2005) and how best to design and evaluate professional development in light of these processes (Putnam & Borko, 2000; Muijs et al., 2004). Through in-depth interviews with teachers, we found that teachers were influenced by the ideas and practices they encountered in CCOW in a variety of interconnected ways—adapting their classroom practices, adjusting their roles as teachers, and/or securing organizational and informational resources to support their continued improvement.

This methodological lens allowed us to see a range of important shifts in teachers' behaviors and attitudes that might not have been captured by traditional metrics for evaluating professional development. Many of the ways in which teachers were influenced by specific practices in the course fall under what Spillane & Jennings (1997) call below-the-surface changes in instructional practice, which are more difficult to observe or evaluate but potentially more impactful (Coburn, 2003). The interconnections between the affective and cognitive dimensions of teacher learning in the course and the ways in which CCOW provided some teachers with the validation and confidence necessary to pursue changes in practice highlight the importance of the cultural surround in teacher development (e.g., Kirkpatrick & Johnson, 2014). Further, Cohen's (2011) discussion of the challenges of *ambitious teaching*, in which uncertainty and difficulty increase in the quest for deeper understanding, speaks to the messier terrain that teachers described themselves as being better able to traverse with heightened skills, validation, and confidence—benefits derived from both their learning experiences in CCOW, as well as their ongoing online interactions with peers.

The varied impact of professional development on teachers has important implications for the evaluation of professional learning experiences. Even when combined, traditional approaches to measuring the effects of professional development would have missed much of what teachers found meaningful about CCOW. Teachers did change their practices, but often in subtle or unexpected ways that the observational rubrics used in assessing many professional development programs might miss. While measured knowledge and skill likely increased for some teachers, for many teachers discrete knowledge gain had little to do with their changed approach to teaching. Additionally, as others (e.g., Johnson, 2015) have noted, traditional metrics rarely capture teachers' ability to share the practices they learned with others, advocate for resources that may support student learning, or learn more from colleagues in and outside of their school. Perhaps most importantly, because CCOW specifically values student outcomes that are difficult to capture on standardized tests (e.g., creativity, ability to collaborate with others, debugging), assessments of student outcomes might not capture what students gained from their teachers' engagement with CCOW. It is therefore worth considering what kinds of professional development experiences we may be labeling as "ineffective" because the outcomes they supported did not align with the metrics used to evaluate them.

This study also has implications for the design of online professional development experiences, and whether the traditional criteria used for evaluating professional development may constrain such design. Indeed, were CCOW designed to cultivate outcomes measurable by traditional evaluations of professional development, many aspects of the learning experience that influenced teachers' practices in important but unanticipated ways may have been cut or underemphasized. This raises the broader question of how to design for diverse outcomes, both those which have and have not been consciously articulated by course designers. One way in which the designers of CCOW left room for course participants to take the learning of the course in individually or locally meaningful directions was through the final independent project, where teachers took the concepts and skills about Scratch they had learned in the course and applied them in their own way. CCOW was also purposefully designed to build connections that teachers could access beyond the active time period of the course. As described by Kelly, learning how to make use of such connections can enable future learning by gaining greater knowledge and

confidence with utilizing the Internet as a tool for professional growth and development. Because the substance of such future learning cannot be entirely predicted by those designing a learning experience, designers must negotiate tensions that arise between providing teachers direct alignment of learning experience and current issues of practice and allowing for the possibility of new and unexpected ways of using that learning. In particular, while MOOCs can seem to leave room for varied learner intentions and styles through the privileging of learner autonomy, they leave open the question of how designers can anticipate the fact that participants may not always know what they want or need.

As a case study, the present work has only begun to explore the ways in which teachers might make meaning of, and take value from, their learning in a professional development experience. As CCOW was a constructivist learning experience around a content area (Scratch) with its own very particular embedded assumptions about learning, we wonder how the range of teacher learning outcomes would be different in a more traditional setting. Additionally, emerging technologies for online learning have the potential to complicate the picture of what teachers learn from professional development and how that learning can be measured. As such, there is an ongoing need for research that continues to investigate the relationship between the structure and content of the learning experience and the varied forms of learning that may result.

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