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Collected From the Cutting Room Floor: An Examination of Teacher Education Approaches to Digital Video Editing as a Tool for Shifting Classroom Practices

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Abstract

Four separate approaches to employing digital video editing were examined with preservice and in-service teachers in an attempt to find common themes. Though selected from a variety of teacher preparation content areas (special education, literacy, and science). each approach shared several common attributes. Among them were the purposeful disruption of traditional teaching, the promotion of rigorous participation in analysis of effective teaching strategies, and the building of learning communities through apprenticeship models. Implications for teaching, teacher preparation, and research are discussed.

Many education reforms call for teachers to be reflective of their practice, thoughtful in their planning and evaluation, and committed to the notion of lifelong learning during their teacher growth (Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, 2000; International Society for Technology in Education, 2007; National Commission on Mathematics and Science Teaching for the 21st Century, 2000; National Commission on Teaching and America's Future, 1996; National Council of Teachers of Mathematics, 2005). Despite the public call for changes in traditional teaching practices and professional development support of teachers for revising classroom pedagogy, the transformation of classroom teaching practices has been less than dramatic. Furthermore, decades of reform have made few inroads into changing traditional classroom teaching practices, which remain remarkably resilient.

Such institutional resistance to change has been characterized by many contrasts, including one of technology in the workplace of medicine and education. For example, it has been said that if one were to place a doctor from the 1920's in an emergency room today, the doctor would be at a loss of how to perform his or her job effectively. Yet if one were to transplant a teacher from the same 1920's era into today's classroom, the teacher would likely navigate his or her vocation just fine. Such comparisons may be meant as criticisms to the institutions or perhaps the profession itself. However, they may suggest that many of the fixes applied to improving education have been ill-conceived or without the necessary support for critical reflection expected of teachers.

Regardless of the underlying explanation for institutional or pedagogical inertia, disruption in traditional instruction is essential in a rapidly changing world, and teacher reflections supported through a variety of specific uses of video can provide strong support for initiating important change in the classroom.

Our goal was to examine four compelling anecdotes of teacher education, which have each used digital video editing as a process of defining teaching expertise. Our accounts are intended to invite readers into a more complex discussion of future reform and change. By comparing these different uses of digital video editing, teacher educators can refine their approaches to engaging teachers in reflection on their practice in ways that add deserved honor and complexity to the conversation of what constitutes good teaching, reflection, and professional knowledge growth.

Disrupting Traditional Teaching Practices

The literature on video in teacher preparation includes many examples of researchers and teacher educators using classroom excerpts and cases for instruction, few actually focused upon the examination of one's own practice. Possible reasons include the limited experience preservice teachers have in classrooms, limited access to experimental and supportive environments for novice teachers, and the risky nature of exploring firsthand novice attempts to promote fundamental change.

Researchers have sought to define barriers to transforming classroom teaching that are brought to bear on teacher education efforts from a variety of methods and venues (Eick & Reed, 2002; Luft, 2001; Van Driel, De Jong, Beijaard, & Verloop, 2002; Yerrick & Hoving, 2003; Yerrick, Parke, & Nugent, 1997). Just as children's preconceptions shape the way they learn science (Driver, 1990; Osborne & Freyberg, 1985), teachers are influenced by their conceptions of science teaching and their notions of scientific literacy (Abell & Bryan, 1997; Abell, Bryan, & Andersen, 1998; Munby & Russell, 1992).

Engaging teachers in a process of recognizing their own personal beliefs and experiences (both positive and negative) influences how teachers teach science to children (Anning, 1988; van Zee & Roberts, 2001; Yerrick, Ross, & Molebash, 2005). Through thoughtful and structured reflective experiences teachers have demonstrated the propensity to develop a deeper understanding of teaching and to confront less useful characterizations of their knowledge growth (e.g., covering more content). Researchers have reported that some teachers engage in reflection, and through their new frames are more adept at thinking critically about their own teaching as well as the teaching of others (Cochran-Smith, 1991; Hollingsworth, 1989; Osborne & Wittrock, 1983).

In recent decades, personal reflection in and on action (Schon, 1983) has become a central focus for supporting change in classrooms and bringing teachers to an awareness of their actions and intentions. Part of the justification for this approach is grounded in the assumption that teacher dispositions, evolving from a long history of experience, knowledge, and socialization in public schools, play a large role in determining whether teachers will embrace alternative views of classrooms (Clarke, 1994; Clark & Peterson, 1986; Delpit, 1988, 1995; Nieto, 2000; Sweeney, Bula, & Cornett, 2001). As teachers explore the new notions of literacy and inquiry that reforms demand, they are faced with many challenges (Davis, Petish, & Smithey 2006).

One of the challenges for teachers embracing new definitions of literacy is to see beyond their own socialization regarding the ways they have conceptualized their jobs, their roles, their contexts, their content, and their students. For example, new definitions of literacy do not always fit old models of content delivery or means of assessment. As a result, teachers' typical practices and beliefs may be challenged but little support exists for teachers in search of new emerging conceptions of practice. Hence, critical reflection as described by Ginsburg and Clift (1990) is required to synthesize theory and practice.

Such reflection offers moments of tension and perturbations in teachers' personal beliefs. They offer instances of cognitive and even emotional disequilibrium that engage teachers in seeing themselves through the eyes of another—a process, Richardson (1996) argued, that some teachers are unable or unwilling to extrapolate into their own future practices. When teachers reflect in ways that are aimed at explaining their reasoning and defending practices with current learning theory, it also "enhances understanding or readiness for acting in the moment" and, as such, "their future praxis will likely change" (Roth, 2003, p. 15). However, Roth also warned that reflection on teaching cannot bring about instant change in their teaching.

Video Editing as a Tool of Choice

The use of video as a tool to support preservice teacher learning has a long tradition that includes asking teachers to view cases of best practice (e.g., Lampert & Ball, 1998), and reflect on video of their own teaching (e.g., Calandra, Brantley-Dias, & Dias, 2006). An underlying assumption of these approaches is that preservice teachers have the cultural toolkit necessary to learn from observations of video. Reflection through video could be an improvement over other processes engaging teachers in reflective practices in venues like postteaching interviews, journals, or other contexts.

First, access to video cases provides other venues for expression that supplement written reflection (Ball, 1990; Bryan & Abell, 1999). Second, digital video provides immediate accessibility to data directly following a lesson to promote more authentic peer discourse that is less susceptible to selective memory (Hill, Rowan, & Loewenberg Ball, 2005; Roth, 2003). Finally, video provides users with immediate feedback on their lessons, which is likely to raise important inconsistencies between their professed beliefs and actual practices.

This kind of immediate reflection through video can empower teachers in ways that bring more authenticity to exploring dilemmas in science teaching, since the discourse surrounding their reflection pertains directly to their own beliefs and actions. For example, when a teacher claims to value hands-on activities for assisting students in constructing knowledge, but provides no evidence in the digital video that students were able to use hands-on manipulatives, teachers are challenged to reconcile this disparity.

Exploring Instances of Substantive Change

For these reasons, it is critical for teacher educators to work directly on the observational norms of teachers and attempt to develop their ability to see classrooms the way that expert teachers do—to develop a professional vision (Goodwin, 1994) for the enactment of inquiry pedagogy. There is little precedent across the research disciplines of literacy, special education, and science education exploring the use of digital video to reflect upon actual teaching events. Although support exists for the approach of using video case studies to promote reflection, as well as support for the practice of having teachers explore children's thinking and facilitate lessons in public school contexts, few reports exist of research conducted with teachers reflecting on their own teaching through digital video editing. As we subscribe to the position that teachers, like children, construct their own meaning from events and activities in our courses, our example studies were not designed to generalize the learning of all teachers. Rather our aim was to explore teachers' learning from several similar but contrasting approaches using digital video editing to promote teacher reflection.

Our interest is to transcend projects of different content areas (literacy, science, and special education) to find themes for driving new and substantive discussion surrounding the promotion of best practices and reflection. To our surprise we found that many of the tenets for promoting fundamental changes in our teachers were common across our efforts. We found our approaches shared common themes (see Appendix A) in that we collaborated with participant teachers who were fully open and willing to explore their teaching, with direct feedback for intentionally shifting teaching practices.

Confronting entrenched practices and exposing one's own teaching involves significant risk and the establishment of trust. We work directly and collaboratively in teachers' classrooms, sometimes with their students and often coteaching with them, in order to establish an open repertoire of reflection. The learning relationships that we have developed at a variety of schools and in a variety of content areas share attributes of critical reflection, analysis, and exploration, and our collaborations are deemed fruitful and successful by the teachers with whom we work.

We have compiled here four different designs for examining teaching practices, each conducted by independent researchers for various purposes. After concluding each of these projects, we came together to find common themes running through our work. These themes are explicated in Appendix A. Our compilation focuses upon the self-examination of practice and extending the thinking about teaching beyond typical discussions of teacher reflection and expert practices.

Although efforts have been made to promote best practices by modeling and scaffolding discussions for preservice and in-service teachers, reflecting upon canned, nonimmediate, nonvital instances falls short of promoting the necessary urgency for considering change. Research has borne out that simply modeling best practices or challenging prospective teachers' beliefs is insufficient for making dramatic change (Abell & Bryan, 1997; Abell et al., 1998; Yerrick & Hoving, 2003).

In contrast, these vignettes describe discussions that are close to the heart. It is one thing to critique the teaching practices of others—strangers who have been de-identified and decontextualized to the point where preservice teachers are merely dissecting lessons and offering technical or practical advice. It is quite another to expose oneself publicly to the critique of one's peers—a process of exposing oneself to the surgical knife of critical dissection.

As a result of raising the stakes, providing tools, and establishing supportive communities, teachers' interpretations shifted throughout the process of producing artifacts, and evidence indicates that their identities as teachers as well as learners have been reconsidered. Video production and reflection on practice became a process of reinventing oneself—a process of examining but then recreating one's teacher identity through taking a finer grained look at one's own practice through a focused lens. Our findings contrast typical video usage in teacher preparation, in which teachers reflect upon the practice of others in vicarious case studies or express only happy narratives regarding teaching successes. In what follows, we explore results of three studies where approaches to exploring teachers' strategies through digital video emphasized teachers' own planning and teaching as they edited their video accounts of personal growth.

Approach 1: Sustaining Learning Communities Through Mentorship for Emerging Definitions of Best Practices (Authors Mary Thompson and Randy Yerrick)

There has been a recent influx of literacy coaching into school districts as a model for professional development. While many publicize the benefits of using a variety of literacy coaching models for longlasting and effective change, little research is available outside of the anecdotal that explores how to incorporate literacy coaching as a tool to effectively improve teacher practice and student learning. Through a collaborative with the University at Buffalo and a nearby school district in western New York, we began to look more closely at the literacy coaching models available and to think about how such models of coaching could lead to teacher change with the use of digital video.

Document: Explicit Strategies for Change

The theoretical framework guiding this investigation is a sociocognitive approach to literacy, which instills a belief that literacy is not only the work of the English and English language arts teacher, but literacy is in every part of the school day and beyond.

In taking this stance the district supported a cognitively guided approach to explicit literacy instruction that incorporated ways to teach strategies as a goal for each content teacher. The district had tried to develop this belief 5 years earlier but had difficulty speaking a language that made sense to teachers in science, mathematics, and technology. To understand how to create a community sharing a belief that literacy is the work of every teacher, we began by examining how teachers used strategy-based teaching to learn and understand their content. Strategy-based teaching promotes metacognition and helps students become more independent learners. The goal of strategy-based instruction is to give students tools to be successful learners regardless of the content and task.

Disrupt Traditional Teaching: Promoting Specific Strategies Among Teachers With Mentors Across Content Areas

The district wanted everyone to speak a common language from the kindergarten to senior high classrooms. Creating a common thread of what literacy is and how it might be taught was considered a powerful tool on which teachers and students could build a strong foundation for learning. To do this, a strategy model of instruction was infused with common semantics about how to assist learners at every level as well as strategies that would transfer to student learning. Appendix B shows the basic tenets of this model.

In creating a literacy model for our collaborative work, selected mentor teachers were paid by the district to work closely with a small group of other mentor teachers in their building and a university literacy professor. Mentor teachers each worked with a new teacher in their building with the goal to slowly change the culture and work of literacy as strategy-based instruction across the district.

This approach engaged teachers to look at their practice from a different angle than what was previously instilled in the new teacher-mentoring program. In the mentoring program literacy had to be tied to a specific strategy and had to have more direct modeling and instruction about how the strategy as a literacy tool would assist students in learning the content. A prevalent metaphor that emerged was the toolbox idea that every tool (strategy) has a purpose and using the wrong tool for a job (learning) makes the work of learning harder.

Teachers needed to understand that learning how to read a graph is important for the math classroom and requires students to read for information differently than learning about metaphor and simile through poetry. We wanted teachers to think specifically about the tools needed to learn their content and to use them explicitly to teach across the content areas. This concept became known as the conditions of learning, and each strategy was taught using the guided model to think about the ways in which the strategy was introduced, guided, practiced, and processed throughout the teaching of a strategy lesson.

Influence Change: Video as a Tool for Learning and Reflection

The analysis of teaching through strategies gave teachers a tool for talking about and sharing what was working and what was missing in their instruction. They knew that many of their students struggled with content but had difficulty understanding where and why the breakdown occurred. The tool became a powerful way to share a language about learning, even though as content teachers they knew little about each others' areas of expertise.

In using video analysis for examining strategy we also had to create a community environment of learners willing to take risks in their teaching. This process was scaffolded and required that teachers think about themselves and their professional work in a new manner. Specifically, teachers had to see analysis of their teaching as a worthwhile endeavor and use it to inform their everyday work with students. This change was not easy as, up to this point, the district used scripted evaluation for mentor work. The work of video as a teaching tool was seen as a potential for intrusion. The video process influenced self-awareness and required teachers to watch themselves through a new lens. Many teachers took up this process differently, and it ultimately had an effect on their growth within the model over time.

Raise Rigor: Using Video to Explicate Strategies

The ultimate goal for the consultant in these one-on-one conversations was to record and comment on the learning processes teachers took on as they thought about themselves as teachers of good strategies before thinking about their content teaching. There was also an effort to name the specific strategies observed that assisted in the teaching of content and drove student learning. Lessons were then digitally taped and burnt to DVD for teachers to watch on their own before meeting with the literacy consultant. After both the consultant and teachers watched the DVD independently, they watched the lesson together with the strategy guide to analyze each section and to record how teachers saw strategy use in their teaching. The consultant and teacher then set goals for the next lesson. A high school English mentor who struggled early on with this idea said,

> I want every student to love *Animal Farm* like I do, but know that is not possible. I just love good books and I want to instill that in every student in my classroom. I guess strategy can do that some too—but I get your point that no one is going to ask my high school seniors in a job interview about the specific lines from Major's opening speech, but they will ask them about how to think across texts and compare and contrast ideas, predict, and summarize. I get that and I see your point. I never understood why strategy was crucial until you showed me that I wasn't really doing it all.

This English teacher came to see the importance of strategy in his everyday teaching after watching several lessons where no strategy could even be named. In looking closely at and analyzing his teaching on video with a consultant, he began to see his role as teacher differently. Digital video was the first time he had ever been asked to look at how he scaffolded new ideas and information and helped his students learn something by guiding the process of strategy over his love of content.

At the end of the year many of the mentors felt more confident and capable of being able not only to analyze and label their own teaching of strategy, but of being able to see strategies in their peer mentor's teaching. Videos were chosen by each mentor teacher to share with the group of mentors to discuss their learning and how they were working with their students within the model. Mentor teachers met monthly as a whole group to share highlights of their learning and to work on specific strategies and skills that they wanted to discuss to improve their practice. Here is a highlight of some of the ways digital video was reflected on at the end of the year:

Melinda:	I hated seeing myself on video. At first I was looking at my hands. What was I doing with my <u>HANDS</u>?
George:	I know what you mean. I had to look at Mary's [teaching notes] (University consultant) and see what she was writing down while we analyzed my video together. I had no confidence at first in what I was doing.
Sarah:	I always looked forward to watching [the digital video] alone first. I didn't want to see it with Mary at first. I like that we had one-on-one time to see ourselves change. I see my teaching so much more powerfully now, you know—it is hard to believe it has only been a year.
Micah:	Well, I still like to argue over what is a strategy. It is a game to me but I never understood why it needed to be so explicit before watching my kids. I thought I was doing just fine, but now I can see the more explicit I am about the how and the why and the when—the more they really get it.
George:	Exactly! I feel the same way. Sometimes I feel like the digital video is helping me see my students better—better than even myself. I see what I can't see when I am wrapped into my teaching. Digital video made me want to do better. I am so proud of my video lessons now and

> hope to use them with my mentor teacher as an example next year.

Overall, digital video empowered teachers in the literacy mentoring work over the course of the year by allowing them to see for themselves where they needed to learn and by providing a tool to help make it happen. Although professional development has always worked best with differentiated goals and one-on-one support, digital video analysis and discussion lent another set of eyes to the work teachers need to do to see what works and what does not and how to make sense of a new set of ideas. The mentor teachers are currently working in Year 2 of the project gaining more training in strategy-based instruction, while helping a new colleague understand the power of digital videos for analysis and reflection.

Approach 2: Using Video Confessionals in a Service-Learning Course (Author Shelley McLaughlin)

This approach used video editing to document and analyze reflective discourse. The context of this course, offered as a diversity elective at a small private university, was to match undergraduate students with young adults with cognitive and physical disabilities in a service-learning course.

Although individuals with cognitive and physical disabilities and their age-related peers commonly come together in inclusive K-12 schools, they seldom come together in their adult lives. In this course, twice a week 30 education and sports management students walked opposite the early morning rush on campus. The classroom was a basketball court, and students were required to wear matching gym clothes, stopwatches, and whistles.

In collaboration with three local agencies and Special Olympics, this course trained students how to be Special Olympics coaches. With little exposure to the world of disability and even less experience with service-learning, students implemented a Special Olympics Training program and oversaw every detail of a regional basketball competition with more than 400 athletes.

Document: The Use of Video to Appropriate First-Person/Person-First language

As a researcher, I used video confessionals (like those seen on reality television) to impress upon students that the use of outdated language and words to describe people with disabilities—like *crippled*, *handicapped*, and *retarded*—perpetuates old stereotypes. The focus on language was intended to guide preservice teachers to better understand the role of language in their teaching and to guide understanding about how words inform what people think and know.

Society often portrays people with disabilities as helpless or tragic victims. “He’s so cute,” and “She is always happy,” are common phrases that objectify individuals with a developmental or cognitive disability. Awareness is the first step toward correcting this injustice. Yet, reflection upon one’s own use of language and labels brings into sharp focus needed change. For example, descriptive terms should be used as adjectives not as nouns, like addressing students as “the boy with autism” and not the “autistic boy.” This approach to helping students revisit what they say and how they say it broke boundaries, because it was embedded in a video confessional project that required students and teacher alike to feel awkward, overwhelmed, critical, and even sentimental in front of a camera.

Rigor of Participation: Video for Revisitation of Expression

Video afforded the most direct approach to influencing students' perceptions of how they communicated about course content and persons with disabilities. This section outlines structures put in place to support the integration of video confessionals, specifically, (a) providing purposeful and engaging prompts, (b) establishing intentional time allotments, and (c) building professional learning community space

First, guiding questions prompted students to talk once they sat down in front of the camera. Students were allowed to speak with a prompt card. They could adopt any three of the following prompts to structure their reflection.

- Before practice I felt __________.
- During Practice I felt_________.
- Now that practice is over I feel______.
- Today in practice, I noticed__________.
- Now that practice is over, I wonder__________.
- Open response.

The guiding questions were posted every Sunday before class (see Appendix C for questions). For students who had never heard or seen themselves on camera, it was also helpful to let them watch the video confessional from the previous week before starting a new confessional. I committed a block of time (at least 60 minutes) each day following class to watch the video confessionals. Students were responsible for their own learning. By making mistakes and negotiating feelings of inadequacy and frustration, they took ownership for their learning. This change happened midway through the semester when students realized that athletes were finally improving. One student, who started the semester in tears, put it best:

> I wasn't sure this class was going to work for me. I asked you for a paper that first week because I didn't want to video confess. I didn't know what to say, and I'm a quiet person. It was just too much. The stress of this class doubled when I had to collaborate with people who work differently than me. They think I don't care because I'm quiet, but I do. Some coaches I think are rude. Not to the players, but to other coaches. Everyone wants to be the boss. But today, after a month of not knowing what we were doing and especially last week's practice, which sucked, things got better. We are happy in there [referring to the classroom where students met after each practice to plan for the following week].

Structure 1: Purposeful and engaging prompts. The first structure was making these prompts and guiding questions visible. The purpose of the video confessional assignment was for students to reflect on their experience in class but also to incorporate a thoughtful response to that week's guiding question. I scaffolded the use of cue cards so students would know how to start a video confessional. An online social network also complimented the integration of prompts and guiding questions.

Each weekend, students could watch a brief podcast of me introducing the guiding question. They also had to respond to the question by blogging on an online forum. By the time students sat in front of the camera, they had heard the question and seen the ideas of the other students in the class. For many students, their ability to reflect critically improved over time. I assessed this growth by considering how they contrasted and compared their beliefs and perceptions against their experience. I also looked for students who embedded elements of critique into their reflections based on assigned readings.

Structure 2: Intentional time allotment. Intentional time allotment helped me consider what and how students communicated in video confessionals. I set aside a block of time each day to watch them. As a researcher I considered tendencies and looked at ways to code data, but as a teacher I wrote down annotated notes of what students said that day. I waited for students' responses to evolve and see how they might have contributed to certain events. The goal was fro them not to blame or place responsibility on someone or something else, but to develop the self-awareness necessary for critical reflection.

In a few cases the video confessional did not change students' practices or beliefs, but a foundation was laid for later understanding and reflection. By preserving this time and process as sacred, I formatively assessed what students said and what they did not. One student, after rambling on and on, finally confessed, "I posted my thoughts after I read everyone else's blogs, but I really don't have a clue." Without video, I would have never known. Students would have been able to cover up this lack of understanding in their writing. I reaped the benefits of noting phrases that enabled me to repeat student thinking to them the following week.

Structure 3: Professional learning community space. The third structure essential to my use of video was establishing trust within our learning community. In the beginning, most students were methodical in their confessions. "Hi my name is __ and today I felt..." As time passed, student voices emerged less rehearsed, as revealed by the pauses, sighs, smiles, jokes, and a few tears. Some students talked about stressors outside of class (i.e., stress related to other courses, roommates, or work), which I perceived as an indicator that they trusted me. Particular to the use of video, knowing that I needed students to trust me to reflect openly and honestly, I emphasized modeling how to video confess and be a critical thinker, made time to connect informally, and capitalized on video snippets to extend learning.

Disrupt: Video Confessional as a Tool for Change

The overall process for this structure evolved from modeling the process for the students to connecting my agendas as an instructor with the context and subjects of the service learning setting. Finally, I used the snippets to share and extend the learning of my students. The following is an example from a multiple week event.

Modeling. To invite students to the process I began video confessing after the third week. This decision left me silent in front of the camera at first. On video I was visibly exhausted, but optimistic and open, and that is what students related to. When students watched this particular confession, they realized that I understood how it was to sit in front of a camera and reflect out loud. They noted as most meaningful seeing me in front of the camera struggling in many of the same ways they did. We were able to connect about why confessing on video was both eye opening and visceral in terms of our emotional commitment to the process.

Connecting. After reviewing confessionals, I would respond informally via email, talking to them before practice or assisting them with a particular athlete.

Extending. As the weeks progressed, I obtained permission from a few students each week to share snippets of their confessionals or on-camera bloopers (i.e., students not realizing the camera was on or accidentally moving the camera so the sound stopped).

Influence Change: Memory and Practice

Trust developed as a result of taking time to model the process, connecting with students on an individual basis in informal ways, and extending the benefits of video as a teaching tool on the topic of critical reflection. Trust also resulted from my maintaining the role of facilitator, which is critical for constructivist teaching.

The use of video editing in teacher education promoted a constructivist learning environment by providing students a mirror to see themselves and to practice critical reflection. Talking about disability required the practice of mixing a unique vocabulary with awareness. What was powerful about the use of video in this project was that video confessionals enabled me to monitor and instruct students' use of first-person language and their meta-awareness of the person over the disability. It also allowed me to view them as individuals in the learning process.

The level of self-awareness that evolved when students watched their confessionals is an example of how constructivist learning has the potential to transform practices and beliefs, because it requires students to become aware of how language informs beliefs. It is also a testament to the benefit of using video within the context of an experiential course that promotes reflection.

Video reflection matters because it anchors us in humility differently in a video form. We have to see ourselves unveiled. In video form words are colored with emotion, tone, and gesture, while in a written form words are more edited and more carefully construed. The reader can intuit the author differently. Unlike written journals, video confessionals promote an alternate textuality—a new form of sharing that promotes review and revision for students to access and consider.

In contrast to the typical written journaling assignments with a traditional orientation toward text, students' experiences of watching themselves reflect and talk about disability over time allowed them to leverage a sense of humility and redefine it as learning. They were also able to see change in themselves that went beyond words to the larger text of how they portrayed disability in their gestures, facial expressions, and tone over time.

Approach 3. Defining Expertise Through Developed Coding Systems (Author Scott MacDonald)

This research approach focused on engaging teachers in coding their own videos of practice. The process of reflecting upon specific instances of science teaching for the purpose of generating an evidence-based account draws from two theoretical commitments. The first is the notion that the nature of science teaching expertise involves a specific set of knowledge and tools employed in contextually relevant ways. My colleagues and I conceptualize this expertise as a cultural toolset using Goodwin's (1994) notion of professional vision. Included in this toolset are particular sets of assets teachers develop and draw upon as they grow as teachers that are consistent with their overall vision for themselves and their students and that guide their choices for professional development and lesson implementation.

Our focus was on understanding how the professional pedagogical vision of preservice teachers can be developed through systematic analysis of video of science teaching. Through a series of video analysis tasks that include practice examples from expert teachers, university faculty, their peers, and themselves, students used these commitments as a guide for the development of a framework for describing the discourse of teachers and students in science classrooms. Bereiter's (1994) four commitments of mutual understanding, empirical testability, expansion, and openness served as a guide to document, define, log, and share what they found in their video practice.

Document: Video Codes Explicating Inquiry and Disrupting Practice

Video coding served to document more explicitly what teachers meant when they used descriptions and phrases like "inquiry teaching" or "progressive discourse," because it required them to match a specific event with a use of that definition or phrase. It served then to guide preservice teachers to better understand inquiry, as well as to identify and disrupt ill-defined or traditional forms of science instruction documented in classrooms. The coding framework the students developed grounded more theoretical notions of science classroom discourse students had read in examples of real practice the preservice teachers had observed.

Students had read and were familiar with the *National Science Education Standards* (National Research Council [NRC], 1996) and the essential elements of inquiry they described. However, while some elements of inquiry helped them think about what activities they would do with their students (e.g., engaging students with scientific questions), more vivid action examples and concrete vignettes helped students think about how to talk with their students during those activities.

Many forms of teacher discourse can mask the manipulation and constrained direction conversations can take, despite the opening of class with a good scientific question (Carlsen, 1991, 1993; Cazden, 1988; Lemke, 1990). Explicating when and how scientific discourse was promoted in the classroom and when it was thwarted was a way for students to hone their thinking about inquiry teaching. As one student noted,

> I was really surprised to see how different teachers can take something a student says in so many different directions. I guess I just thought that when a student gave an answer it was my job as the teacher to say yes or no. I see now that really my job is to use that idea to build something about how they understand what we are learning.

In these ways, coding videos as a way of understanding inquiry moved students away from traditional notions of teaching and toward new ventures.

Increase Rigor of Participation: Video Coding for Evaluating Pedagogical Options

Understanding which activities to engage students in is important, but only by understanding the larger purpose can teachers make choices about how to support and guide the conversation around those activities. Science teachers are rarely afforded formal opportunities to discuss argumentation. Coding videos increased preservice teachers' typical rigor of analysis by requiring them to consider which domains of knowledge they were using and developing a coding scheme that demonstrated a cogent argument for what that looked like. More progressive discourse provided this larger purpose in the form of classroom norms and a shared sense of purpose in the science classroom.

Throughout the semester participants in the class analyzed video of the course's faculty member, their peers, and themselves, along with video of other teachers in the field. The first for preservice teachers was the analysis of a high school chemistry lesson. With a partner, students were taught the analysis tool, the use of codes, and the utilization of the four Bereiter (1994) commitments for analysis of actual teaching events.

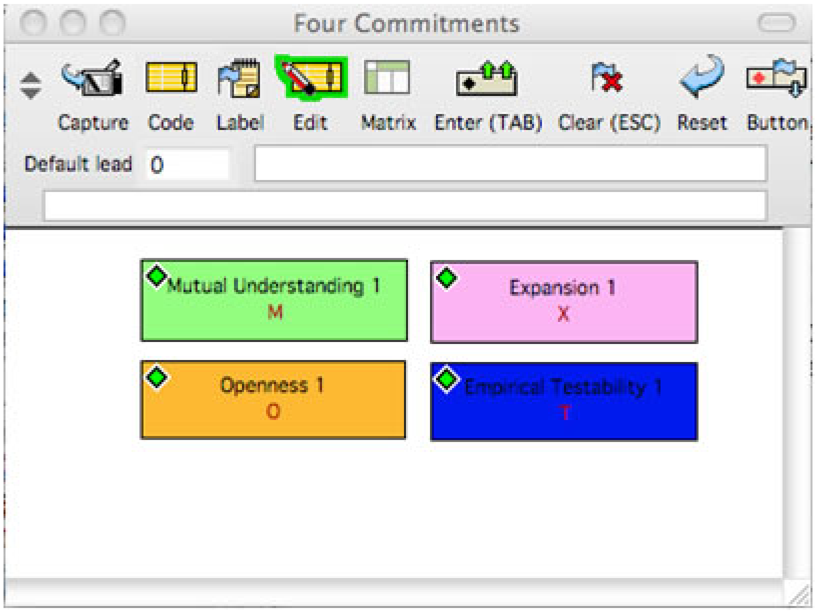

Figure 1. Studiocode Code Input Window From Approach #3

This initial analysis task was used as a baseline for teacher reflection, as they were given the same task with the same video at the end of the semester. This initial task was followed by a discussion that unpacked components of the analyzed lesson in terms of what the preservice teachers attended to and how they interpreted the viewed activity. The video analysis task focused on enculturating preservice teachers to a framework for understanding teaching, specifically how to support evidence-based science discourse in the classroom.

Preservice teachers were asked to use their own analysis of video to construct evidence-based arguments about the nature of inquiry science teaching in practice. Without video coding as a tool, confronting preservice teachers' implicit conceptions of excellent science teaching is more of a challenge, as categories and assumptions are rarely explicitly defined. Preservice science teachers needed to have some form of comparison as a control that required them to make defensible claims about practice. One of the advantages of video as a tool was the possibility of returning repeatedly to an instance of practice and coming to consensus about an interpretation of events and codes. This activity is particularly important when students are attempting to make claims about their own teaching.

At the end of the semester all the preservice teachers reanalyzed the original video of high school chemistry teaching using the adopted framework. This final piece of analysis served as a final assessment for the course, and preservice teachers were given access to comparisons of pre and post analysis. Interviews with preservice teachers revealed major shifts in the ways they justified claims made about the videos using evidence of learning revealed within the video excerpts. Through this process, observations and analysis formed the beginning of a guided teacher inquiry as well as an assessment of their abilities to reflect critically and construct evidence-based arguments surrounding the nature of science inquiry teaching.

Influence Change: Video Codes Promoted an Apprenticeship Model and Promoted Community Building

One of the ways video coding created a strong community and promoted apprenticeship of teachers was by inviting all teachers to participate in conversations to critique and analyze third party videos regarding their own epistemological convictions about science teaching. Though students were guided in the skills and dispositions to build arguments with the new tools and framework, they were encouraged to value a variety of perspectives and were not allowed to dismiss or condemn alternative interpretations.

Students produced codes for analyzing teachers, and these were kept in the form of coding input windows for Studiocode, software used for all the digital video analysis during the course. These coding input windows (see Figure 1) were shared easily between class members either via email or USB flash drive. Students shared their timeline documents, which are a record of the way they coded a particular video (see Figure 2).

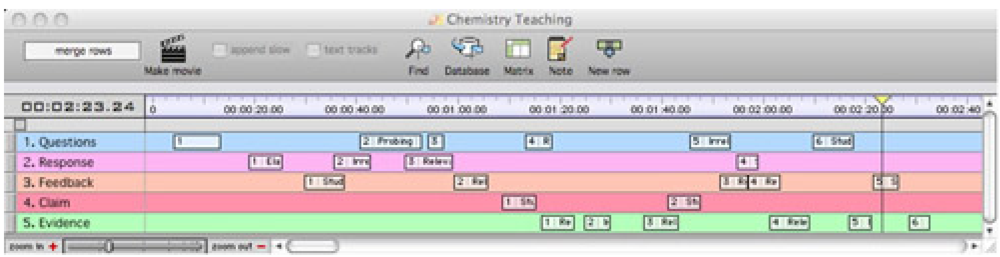

Figure 2. Studiocode Timeline Window From Approach #3

Teachers used an observation-based approach for their coding schemes to construct collaboratively a framework for the requisite knowledge of science teachers. They also built a consensus about the importance of teacher expertise about student ideas and how they can be used as the foundation for developing a community of science learners. They expressed these ideas in both their written work and their discussions of practice.

Preservice teachers reported that this consensus-building process formed a critical community that was unprecedented in their program. It provided an apprenticeship for teachers by providing equipment, time, space, and a framework for examining teaching with experts whose lessons they had observed firsthand. Preservice teachers' talk about science teaching expertise and student classroom talk was significantly enriched as they discussed issues of teaching in a safe, collegial venue.

With a more focused and deeper understanding of science classroom discourse stimulated by coding and analyzing teaching events, teachers are more likely to base their self-evaluations of their own effectiveness upon something more substantive than classroom management or standardized test scores. One student commented, "It really changed the way I think about teaching. I am more of an orchestra conductor who makes all the instruments work together to learn science."

By having preservice teachers collaboratively analyze video through coding schemes and publicly debate the merits of their view, we were able to accomplish several outcomes which otherwise plague preservice science teacher educators. First, coding was useful in disrupting a traditional orientation toward science teaching, which has been so widely critiqued. Next, video coding allowed teacher educators to press their students to be more rigorous about their definitions of inquiry science teaching. Preservice teachers needed to justify their interpretations of effective science teaching using actual video vignettes and evidence for their coding schemes. As such, they were not allowed to make overgeneralized assertions or unsubstantiated claims about teaching and learning. Their peers and their instructor required them to construct a convincing case about their own teaching by using examples of practice, not just recollections of what they think happened. Finally, the process of working through challenges of interpretation and the development of trust and common language afforded preservice science teachers a venue to think through difficult issues associated with inquiry teaching.

Approach 4. The Examination of Preservice SMET Service Learning Outreach via Video Editing (Authors Randy Yerrick and Mary Thompson)

Disrupt: Shifting Certification Candidate Dispositions

This approach addressed preservice science teacher learning in an introductory technology class. In typical technology courses offered within a university teacher certification program, preservice teachers learn to use technology tools separate from reflecting on their role as teacher (Cuban, 2001; Windschitl, & Sahl, 2002). Whether universities choose this venue in an altruistic attempt to shield novice teachers from the obstacles of real school demands or an attempt to lower the demands on the university instructor by keeping candidates sheltered in a lab environment, this sterile environment does little to help novice teachers attain complex pedagogical, technological, and content knowledge and is likely a contributor to the limited amount of use and even intended use by graduating teacher candidates (Becker & Riel, 2000; Cuban, 2001; Pflaum, 2001; Rakes, Flowers, Casey, & Santana, 2001; Runge et al., 1999;).

In contrast, we introduced preservice teachers to a variety of technologies purported in the research literature to improve science teaching like probeware, laptops, graphical analysis tools, digital media editors, and data mining tools (Runge et al., 1999; Trimmel & Bachmann, 2004). We aimed to disrupt the potential lethargy associated with simply fulfilling certification course credit to increase their growth in specific domains of knowledge that would better prepare them to implement technology in real classroom environments.

From the onset preservice teachers were aware that their learning of specific tools would produce lessons that they would teach and record. In this way we disrupted the patterns of learning about technology with the expectation that recorded lessons would be edited and shared publicly through the Web at semester's end. Our intention was to increase the investment and ownership for novice teachers through the development and implementation of lessons disrupting their role as students—expecting them to act as expert teachers who would be directly soliciting feedback from the middle and high school science students they would teach in local schools.

The venues in which we immersed our novice teachers were all schools that housed excellent teachers who had received less than exemplary support from their technology departments. The university provided both tools and professional development for public school teachers. Expert teachers who had struggled to implement new technology could observe best practices enacted in their classroom with minimal investment—allowing them to debrief with preservice teachers and university faculty in nonthreatening ways. In this way our collaboration met experienced teachers' needs and requests for equipment and training, while preservice teachers were provided a safe, experimental classroom in which to try on their new role as science teacher. In this service learning model of professional development novice teachers also were exposed to active university-school collaborations and saw firsthand the give and take required.

Increase Rigor: Digital Video Production and Ownership of Planned/Shared Science Lessons

Immediately following the teaching, novice teachers were required to edit and publish excerpts of their lessons. Digital video increased the rigor of reflecting upon practice. Instead of reporting what happened, teachers were expected to turn a critical eye toward their collected video, assessments, artifacts, and cooperating teachers' reflections and create video exhibits to synthesize an argument for why the tool and teaching strategies they chose were improvements over traditional practices. Given the artifacts of learning they could no longer rely upon remembered accounts, but editing and peer reviews required details of teaching. In each case preservice teachers were required to interview and solicit feedback from their instructor, a public school science teacher, and at least five students who had participated in the lesson. This strategy resulted in buy-in for preservice teachers and enhanced their level of reflective rigor.

Two of the tools preservice teachers chose to implement during their lessons included probeware and MacBook computers. Lessons designed for scientific data gathered by probeware were favored over traditional data-gathering equipment (e.g., glass thermometers). Data would have been much less accurate and more difficult to collect without the use of a laptop computer to monitor and analyze it. Teachers commented on the discrepancies between the traditional teaching methods used for labs and those demonstrated by students enrolled in this course. One teacher reported,

> We chose a tool that is more robust, accurate and efficient than the classic tool available in a typical lab. We were able to incorporate this technology with a very brief training [with children] at the beginning of the exercise. As the technology did the busy-work portion of the exercise [data collection at routine intervals], the students could think about what it all meant.

Through these kinds of lessons preservice teachers were learning more about lessons that reflected expectations of *National Science Education Standards* (NRC, 1996) and thinking more about what acting like a scientist means. Another teacher described the lesson as more rigorous than lessons observed elsewhere: "Using these kinds of modern scientific tools revolutionizes data gathering in the classroom and streamlines the process of experimentation, discovery, and drawing accurate conclusions."

By having students commit to public scrutiny of their best thinking so far, put it into a functional lesson plan, teach the lesson to students, and then publicly reflect upon their efforts with the recipients of their teaching, these novice teachers engaged in a more rigorous approach to learning to teach. In fact, one teacher commented, "This class is easily three times more work than any course I have taken so far...but it's worth it."

More examples of students' comments as well as examples of students' processes of data collection during labs can be found on the Web:

http://web.me.com/yerrick/MacBooks_and_Probeware/Lessons_learned_teaching_chemistry.html

http://gsewebvm.gse.buffalo.edu/fas/yerrick/Learning_From_Childrens_Voices/Introduction.html

Document: Digital Video Editing Facilitated Critical Reflection and Analysis

Several documented approaches exist for using video to promote novice teacher thinking about exemplary practice. However, few cases are documented regarding novice science teachers' abilities to analyze their own efforts to teach with the *National Science Education Standards* (NRC, 1996) in mind. We intentionally raised the rigor of analysis of classroom interactions by requiring teachers to document consistent *and* inconsistent events through video. Many experienced, as well as novice, teachers observe complex approaches to teaching, like problem-based learning or science-technology-society (Solomon & Aikenhead 1994) approaches and assume they are already implementing them. They use phrases like "dovetail" or "incorporating it into my current teaching," which suggests they view constructivist notions of learning to be *added to* their existing repertoire. This outcome can be common when students are asked to reflect through written journals requiring no external artifacts.

In contrast, our students were required to look at their teaching within 2 days and reflect with an experienced mentor teacher about the strengths and weaknesses of their plan and implementation. As a result, novice teachers critically examined, through others' voices and example video they had collected from each lesson, whether they felt that they had truly achieved their goals. One teacher was critical of his own teaching efforts, as he bemoaned his tendency to short-circuit student thinking and not let students solve their own problems: "Cool experiments are only really interesting to students if you can connect it to their interests. Make sure the students are solving problems for themselves. You can advise, but learning comes through effort."

Another peer teacher was more positive about this teachers' effort, praising his efforts in the science classroom. This peer noted that the choice of technology was appropriate and the lesson was well devised, claiming, "Technology cannot turn a poor lesson into a good lesson, it should only be used if it really is the best tool for the job. Powerpoint doesn't make presentations better, just easier [for the teacher]."

Prior to teaching lessons teachers often would interview students to reveal their prior knowledge about phenomena related to their intended concept. In one lesson, many students revealed their belief that because energy was added to ice the temperature would increase. In addition, students also believed that adding heat would always increase the temperature of the ice. Contrary to these beliefs, measurements students collected revealed that every calorie absorbed went directly into breaking the molecular bonds of solid ice molecules prior to the ice increasing even 0.01 degree. By using the temperature probe, students were able to get a temperature reading with a tenth of a degree of accuracy and perform more measurements for reliability.

When students were tested after the lesson by their public school teacher, the average increase in students' proficiency for this lab was more than 10% over the year before. Although the previous years' average for this unit test was around a 75%, the student average on the unit test was an 87%, and the performance-based assessment the teacher administered to measure laboratory skills revealed greater gains.

The teacher attributed a large part of this increase to the relative ease of data collection and increased time for discussion about the concepts, as opposed to extended set up and data collection time. Teachers gathered video reflections of students after the lab, where students commented that they were able to complete the lab faster, get more accurate temperature readings, and felt that they were doing experiments that felt more like "real science."

Teachers' growth in assessing students beyond standardized tests and connecting outcomes with specific aspects of lessons can be a strong indicator of their improved ability to analyze and critically reflect upon teacher knowledge. Teachers were less likely to be satisfied that their students understood simply because of high test scores. Rather, many appropriated a problem-based learning approach, often used as a means to connect students' interests and sense of community responsibility to concepts taught in the classroom. When asked what would be the best indicator of middle and high school students' learning. one preservice teacher responded,

Insightful questions are the best indicator. A student asking a question that is indirectly related to the exercise is demonstrating their ability to extend learning to other topics. In this lesson, we had one or two really good questions, but I bet other students thought of things that they never brought to our attention.

Our efforts to engage teachers in editing their own digital video reflections scaffolded a kind of analytic rigor that connected children's actions and thoughts with teachers' tools and methods. More examples of teachers' critical reflections and analysis of science lessons, as well as students' artifacts can be found on the Web:

http://gsewebvm.gse.buffalo.edu/fas/yerrick/Problem_Based_Learning_In_Science_Teaching/Introduction.html

http://gsewebvm.gse.buffalo.edu/fas/yerrick/Expanding_Preservice_Science_Teachers/Introduction.html

http://gsewebvm.gse.buffalo.edu/fas/yerrick/Freezing_Point_Depression/Introduction.html

http://gsewebvm.gse.buffalo.edu/fas/yerrick/Losing_Heat_IS_NOT_Always_Cool/Introduction.html

Influence Change: Digital Video Leveraged Existing Apprenticeship Roles

As university professors we had spent much time in our collaborating teachers' classrooms researching, teaching, and planning prior to introducing our novice teachers to our expert collaborators. We were well aware of some of the limitations to our approach and even some of the obstacles we would face implementing new tools (e.g., video permissions, bias in collecting artifacts from only successful students).

During the planning of their lessons novice teachers would meet and discuss their lessons, asking for practical suggestions as well as considerations to extend lessons beyond the classroom environment. One preservice teacher described her relationship with her assigned collaborating teacher as one of a "good mentor." Her teacher had suggested that one time would not be enough to know whether her plan was good or not. She graciously agreed to teach more than one class and believed it benefited her as a teacher: "Although it seems like a lot, try to teach more than one class period in the classroom you are assigned. This way you can make changes right away in the second and third classes."

By her third effort, and after reflecting with her collaborating teacher, the preservice teacher believed she was actually achieving her goals: "Technology was an enabler for gathering and presenting data so that the students could focus on analysis."

The relationship established between these two teachers turned out to be of mutual benefit. The more experienced teacher had been wanting to implement some new tools he had seen but that the district did not own. Not only did he get to borrow the equipment, but also he received some mentoring from the new teacher and the university professor regarding the use of the tools. The less experienced teacher was able to share what she had learned in her university course with the teacher in a spirit of reciprocity for offering up his class as a lab environment. The cooperating teacher said, "My students were eager to use the probes in their classroom the next year and offered some advice on how to improve the lesson."

Another student reported similar reciprocity with her collaborating teacher:

> As I was preparing to teach I was also learning how to use the technology. I have never used the probes we used in this lesson before. During the teaching, I learned how to organize the time and what questions to ask during the first class. I was able to improve the lesson during the second class. Looking back, I learned how to use the probe technology with real students and how to be flexible when things go wrong during the lesson.

Teachers continue to offer their classrooms as supportive apprenticeship environments to these efforts and feel that it is worth their time and energy to invite professors and novice teachers to teach, explore, and analyze teaching efforts with new technologies. More examples of these apprenticeship collaborations can be found on the Web:

http://gsewebvm.gse.buffalo.edu/fas/yerrick/Stop_Faking_It!/Introduction.html

http://gsewebvm.gse.buffalo.edu/fas/yerrick/Hoo_Knows_Where_the_Energy_Goes/Overview.html

Promote Community: Digital Video and Its Role in Professional Support

The efforts to capture and reflect upon good use of technology in the science classroom has culminated in a collection of artifacts from a broad range of contributors. Each of the teachers and authors of the digital video collections share openly their artifacts, lessons, and reflections with one another in a variety of venues. This kind of open planning and sharing has led to a strong sense of community uncommon to the typical divide existing between the academy and public school classrooms. Because authors each freely shared instances of their teaching and invited commentary on their best artifacts, communication and commitment was deeper and more extensive. For example, after working to improve a lab required in New York state one, a teacher complimented a preservice teacher regarding the improvement on the way the lab had been done in prior years as a traditional science lesson: "We were able to present an otherwise completely standard lab in a new light and remove the drudgery that is typical."

In response, the preservice teacher recognized the shortcomings in her lessons after meeting and talking openly with her collaborating teacher. Overall, the collective view of the process of sharing with other teachers was quite collegial, especially considering they had no teaching experience yet on which to base their predictions. One teacher reported, “We were able to see if the lesson actually worked with real people. We were able to see problems that came up that we might not have thought about when organizing the lesson on paper.”

The collection of videos and artifacts continued to promote community building after the completion of each semester as the collection provided insight by creating an archive of video excerpts and reflections for specific tools for teachers of the region as well as for future students of the university course. Many of the examples were shared with a worldwide audience at the Apple Learning Interchange. The following are remarks shared by two teachers:

Preparing the exhibit made me focus on all the parts of a really good lesson, its not just an activity and a product. The background is very important. The exhibit was the best part—thinking about what other teachers would want—thinking what I would want as a teacher. Preparing the exhibit showed me how students can display their own work that they do in my classroom.

Another expert teacher of some 16 years produced a video exhibit along with the preservice teachers, explaining how technology had improved one of the labs she had struggled to teach every year.

> So this year with my probeware and my MacBooks, the phase change lab worked....My colleague said, “it’s a shame that lab never works.” I showed her and said, “This is what my students did.” I showed this woman my graph, and she was like, “Doh! Oh my gosh. This never works.” I told her, “I know, and it did this time.”

She continued,

> It’s made me want to be a better teacher....It’s making me really go back and think about and re-evaluate the things that I have been doing. “Why am I doing them? Are they helping kids? Is there a better way?” And I’m finding a better way, and that’s making me inspired.

Such insights gleaned from expert collaborating teachers can also help in directing future outreach and research approaches for studying implementation of technology tools in the classroom. Editing digital video examples of science teaching expands the researchers’ views of how collaborations and service learning venues with public schools can provide deep insights into teaching and inform new avenues of research needed with new specific tools that are currently being launched for science teaching.

Discussion

These professional development efforts to examine teaching vignettes offer opportunities that are unavailable when using traditional case studies. We have found that, when preservice and in-service teachers read or watch examples of others teaching, many counterproductive social patterns populate our efforts to press in on critical reflection. Disruptive and typical patterns of response include the predisposition of some preservice teachers to be openly dismissive of exemplary inquiry teaching vignettes. Some assume their own teaching would be richer, more effective, more straightforward, and without complication. If we are to move engaged but reticent teachers forward, we must create challenging yet supportive environments in which to be critical of actual teaching events.

Just as it is important for science students to have direct experiences that counter their alternative conceptions, it is necessary for teachers to delve into the discrepancies between their beliefs about effective teaching and what they observe in their own teaching excerpts as they construct arguments, code video, and share personal and sometimes painful experiences that move them forward in their thinking.

Prior to the availability of digital video, it was difficult to engage teachers in such events. We found teachers could often write about their teaching experiences, but their written version was influenced by their own perceptions, memories, and desire to present a positive image. Shared artifacts often focused upon only happy endings or victory narratives—success stories absent of any struggle or complexity. Teachers were also invited to watch a VHS/DVD video of their teaching, but due to time constraints or a dislike of watching themselves on tape, they typically only watched it once, and their reflections were shallow and remained at the descriptive level.

Digital video is more effective because of the nature of the investment and the depth of interaction surrounding the taping, planning, and reflection on the final vignette and participating in the editing process. The extended engagement with their own teaching examples caused them to think more critically about how their practice aligned with their beliefs. Digital video and the applied tools for constructing artifacts through this venue were central for constructing meaning of the intentions and context embedded in the complex teaching examples shared by all the learning communities.

While video has been used for reflection and teacher change in the past, digital video editing as a tool for analysis is still rather new to teaching and professional development. In all three approaches described here, digital video editing empowered teachers in the process of critically evaluating teaching, even in the period of a single semester. This time frame is relatively short for shifting teacher knowledge and expertise, but we attribute the quickened pace to the context set up for digital analysis and discussion, which lent another set of eyes to the work teachers need to do to see what works, what does not, and how to make sense of a new set of ideas

Our four separate approaches to employing digital video as a means for reflection revealed with preservice and in-service teachers and across content areas that teachers' practices can be influenced and shaped in authentic contexts with significant support and rigor. Common themes that emerged from data across all four projects were predicated upon such facets of professional development as purposeful disruption of traditional teaching, the promotion of rigorous participation in analysis of effective teaching strategies, and the building of learning communities through apprenticeship models.

Though these themes were common across all institutions and emerged independent of any collaboration between institutions, we are hesitant to suggest that these are prerequisites for making change. Rather, we see them as perhaps natural outgrowths of authentic research conducted in truly collaborative learning communities, where power, privilege, and voice are mutually negotiated among partners. Future research efforts should explore to what degree such environments are sustainable or may emerge without the direct involvement of university researchers, as such collaborations are highly labor intensive and fiscally expensive to maintain without outside funding.

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Appendix A
Common Themes Across Approaches

Approach 1 used DV to…	**Approach 2 used DV to…**	**Approach 3 used DV to…**	**Approach 4 used DV to…**
Document explicit teaching strategies and guide teachers to better understanding.	*Document* weekly reflections and guide pre-service teachers to better understand /consider their learning over time.	*Document* teacher discourse and guide pre-service teachers to better understand inquiry.	*Document* instances of teaching and to give specific feedback to pre-service teachers about actual events which transpired in their devised lessons.
Disrupt traditional forms of professional development among experienced teachers and traditional teaching approaches.	*Disrupt* traditional forms of reflection in a service-learning course.	*Disrupt* traditional forms of instruction in a Science Methods course.	*Disrupt* the pattern of meeting checklists and turn the attention to reflective practice. To disrupt the tendency to complete assignments, take coursework and complete checklists.
Influence change by influencing self-awareness/ growth/ and learning over time.	*Influence change* by having students video confess in response to structured prompts.	*Influence change* by making explicit the differences between memory and actual practice.	*Influence change* by having students invest in a technological innovation which suited their educational philosophy and watch themselves teach with it to better match their beliefs and actions.
Raise the rigor of participation by requiring students and teachers to be uncomfortable. We enticed	*Raise the rigor of participation* through video confessionals as	*Raise the rigor of participation* by requiring	*Raise the rigor of participation* by having students commit

them to join us and trust that using video as a way to see oneself teach and/or reflect would result in learning	confession was not easy for students. Many were concerned that they had to say the right thing, they wanted to "perform"	students to participate in conversations regarding epistemological convictions about science teaching.	to public scrutiny of their best work and then publicly reflect upon their efforts with the recipients of their teaching (students and teachers).
Increase the rigor of analysis by scaffolding the process by which participants analyzed video clips. By engaging learners to get comfortable seeing and hearing themselves on video they were inclined to observe and critique aspects of their teaching/reflecting that would have been forgotten or missed had video not been used.	*Increase the rigor of analysis* since students had never been asked to consider growth over time and use video clips to demonstrate that growth. They owned their learning and the language they used. Video helped make clear how their use of language and references to disability changed/evolved.	*Increase the rigor of analysis* by requiring pre-service science teachers to consider which domains of knowledge they were using and developing a coding scheme which demonstrated a cogent argument for what that looked like.	*Increase the rigor of analysis* for students by means of asking them to document through video actual events which may or may not match their recollection. Rather than reflecting through written journals with little if any artifacts, students were required to look at their teaching within 2 days and reflect with an experienced mentor teacher about the strengths and weaknesses of their plan and implementation.
Promote an apprenticeship model The apprenticeship model - we modeled the practice of teaching or reflecting on video, we didn't just give them a camera without scaffolding the experience.	*Promote an apprenticeship model* since Shelley (just like students) video confessed each week. She used her own VC's to model her learning, growth as a teacher, commitment to	*Promote an apprenticeship model* by providing equipment, time and space for examining teaching with experts who had observed the lessons first hand.	*Promote an apprenticeship model* by providing needed technology in the school and free professional development in exchange for the convenient and supportive

	"disruptive" practice		venue for pre-service teachers to stretch their wings under the guidance of an expert teacher.
Promote community building since each piece hints at a deeper level of community that is not common to PD and undergraduate coursework. Collaborative watching and discussing of video fostered a classroom that was home to reflective practitioners.	*Promote community building* since sharing student clips helped students see and hear that they weren't alone - that coaching was challenging, and there was a high-stakes final exam (the competition).	*Promote community building* by creating an environment where pre-service teachers were required to share their first efforts at teaching in a safe and reciprocal environment.	*Promote community building* insight by creating an archive of video excerpts and reflections for specific tools for teachers of the region as well as for future students of the university course.

Appendix B
Strategy Instruction From Approach 1

Explanation:		
Explicit Teaching Element	**Time Observed**	**Statement Made**
What: Name the strategy being taught		
How: Think aloud how to use the strategy		
***When*:** State when to use the strategy		
Where: State where to use the strategy		
***Why*:** State why to use the strategy		
***Verbalization*:** Time is used to verbalize about strategy use.		
Reduce Processing Demands: Make the abstract concept concrete.		

Appendix C
Sequence of Guiding Questions From Approach 2

Sequence	Guiding Question
1	Introduce yourself and tell me about why you took this course. Have you ever worked with someone (adult or child) with a disability? Do you have any family members of relatives (adult or child) with a disability?
2	This week watch your first video confessional and reflect on what you noticed. What do you hear in your voice? What do your gestures (eye movement, hands) communicate? What does silence communicate?
3	What is Service learning? Why do you think this course is offered here at this particular University?
4	When you visited the Special Olympic website, and watched the video A World of Neglect, what did you think? Why was this video made? Who was the audience? Did it influence you to position yourself differently?
5	In relation to the Special Olympic Language Guide that was posted, what does it mean to use person-first language? Give an example of how it is used in context. Is this something you already do, or is this something that you are working on?
6	What does it mean to be Abled?
7	What was it like to take the athletes to lunch on campus?
8	What was it like to visit athletes at the day-hab center where athletes live and/or attend day classes?
9	Tell me about your coaching philosophy. What makes a good coach? What makes a bad coach?
10	How prepared do you think our athletes are for the competition? Consider the competition from the perspective of a family member or friend, what will they be thinking while they sit in the stands? What will you say or do that day that will be an indicator of your growth this semester?

11	This course will be offered again next spring, what advice do you have for student coaches? What is one thing you wished could have been different about this class? What is one thing that you wouldn't change about this class?