26

Teachers as Designers: Pre and In-Service Teachers' Authoring of Anchor Video as a Means to Professional Development

Anthony J. Petrosino
The University of Texas at Austin

Matthew J. Koehler
Michigan State University

In their influential article, Brown, Collins, and Duguid (1989) emphasized the importance to education of looking carefully at authentic cognition and of creating cognitive apprenticeships based on authentic tasks, defined most simply as the "ordinary practices of the culture" (p. 34). Our focus on the apprenticeship of pre and in-service teachers (i.e., teacher-learners) has led us to toward a consideration of the authentic tasks that would support continued and long-term thinking about classroom cultures, specific problems of practice, and conceptual knowledge. But working within an apprenticeship model inevitably introduces issues of feasibility. For instance, how can we engage teacher-learners in authentic real-word tasks and experiences while staying in the confines of the traditional college and university classroom walls? How can experiences and mentors be provided consistently? Is it possible to provide opportunities to apprentice in a scalable manner?

One approach to address these challenges is anchored instruction [Cognition and Technology Group at Vanderbilt (CTGV), 1990]. Anchored instruction is a technol-

ogy-based learning approach that stresses the importance of placing learning within a meaningful, problem-solving context. Anchored instruction uses context as a learning device. The anchor refers to the bonding of the content within a realistic and authentic context. In anchored instruction, learners are encouraged to not only solve problems, but also to think about the processes involved. Essential to this approach was the use of interactive video within a narrative format. The narrative provided a story and a context while the video provided an essential element to deliver real-world complexity.

The approach taken by anchored instruction (CTGV, 1990) uses video-based "adventures" to initiate sustained exploration by students and teachers into understanding authentic problems. In addition to being more engaging than text (CTGV, 1990), video helps situate learners in a variety of contexts; students can be placed at the feet of a mathematician, at an important moment in history, or even on a field trip to Mars. Bringing students to the corresponding real-life experiences would be difficult at best (if not impossible).

The prototypical incarnation of anchored instruction theory into practice is the creation of "The Adventures of Jasper Woodbury" (a.k.a. "Jasper"). "The Adventures of Jasper Woodbury" consists of 12 videodisc-based adventures (plus video-based analogs, extensions, and teaching tips) that focus on mathematical problem finding and problem solving. Each adventure is designed from the perspective of the standards recommended by the National Council of Teachers of Mathematics (NCTM). Specifically, each adventure provides multiple opportunities for problem solving, reasoning, communication, and making connections to other areas such as science, social studies, literature, and history (CTGV, 1997). The success of the anchored-instruction approach has been well documented in Jasper classrooms (CTGV, 1990, 1997; Hickey, Moore, & Pellegrino, 2001) as well as in the area of specific disciplines such as reading (Sharp et al., 1995) , special education (Glaser, Rieth, Kinzer, Colburn, & Peter, 2000), and science (Goldman et al., 1996; Sherwood, Kinzer, Bransford, & Franks, 1987).

In constructing an anchored approach to the development of teacher-learners, we have also sought to use video as a means of connecting teachers learning to authentic contexts. By connecting knowledge to the contexts in which it is to be used, we are seeking to improve the likelihood that the experiences teacher-learners will be able to apply their knowledge to real classroom situations, and transfer it to other situations and contexts when appropriate (Bransford & Schwartz, 1999). It is worth noting the conceptual and theoretical overlaps between anchored instruction, and case-based approaches insofar as teacher-learners are concerned. In both approaches, authentic contexts are used to engage teacher-learners in the types of thinking they will use in future classrooms. In both, they asked to analyze and reflect about situations, knowledge, theories, and problems. Accordingly, learning in these authentic situations is more likely to bridge the gap between the theory and the practice of teaching (Shulman, 1986, 1992).

Historically, anchor videos were prepackaged for teachers and presented as finished products for practical reasons: (a) Most teachers do not have the time and resources to develop video anchors; (b) most teachers do not have the collaborative support structure needed to take an idea from concept to actualization; and (c) producing video was technically challenging and cost prohibitive. But prepackaging also

made key ideas such as curriculum design, coordination with state and national standards, and finding engaging multistep problems unproblematic to the teacher-learners. Recent advances in hardware and software (e.g., iVideo by Apple) have removed most of the technical barriers to teacher-created video. Also, engaging teacher-learners enrolled in teacher education and master's-level courses can remove the time and support barriers.

But if teacher-learners are not taught and encouraged to design their own curricula, they can have little or no ownership, responsibility, or voice in the curricula process. Traditionally, in colleges of education across the country, curriculum and teaching have been separated. Teacher-learners are not given opportunity to create curriculum, only instruction on how to enact it. The role of design, so prevalent in the development of learning environments, has rarely been accessible to teacher-learners in any meaningful manner (Goldman-Segall, 1998).

Our work is about changing the authentic cultural practice of teaching and teacher education, creating new forms of teaching practice that do not yet exist on a broad scale. By building on the strengths of anchored instruction and the creative possibilities afforded by new technology, we have to look seriously at a reinterpretation of the notion of apprenticeship and teacher education. What can happen if these powerful learning tools are put into the hands of teacher-learners in order to look at their own teaching or to create their own learning environments?

We will detail our efforts to have teachers author their own anchor videos. We present three examples, drawn from our own teaching experiences with pre and in-service teachers. In the first example, preservice teachers in mathematics and science education create their own anchor videos as they develop 4- to 5-week project-based learning curricula. The second example describes preservice teachers' efforts to create best-practice teaching video cases from a library of footage in a K–8 literacy methods class. The third example documents the experiences of master's students (in-service teachers) as they create iVideos (movies that exemplify a big idea in education) as a means of situating learning in educational technology. After describing these examples, we summarize the learning afforded by the teacher as filmmaker approach.

EXAMPLE 1: CREATING ANCHORS FOR PROJECT-BASED INSTRUCTION

Krajcik and his colleagues at the University of Michigan (Krajcik, Czerniak, & Berger, 2002; Krajcik, Soloway, Blumenfeld, & Marx, 1998) have described project-based instruction as engaging learners in exploring authentic, important, and meaningful questions of genuine concern to students. Through a process of scaffolded investigation and collaboration, using the same processes and technologies that experts use, students formulate questions, make predictions, design investigations, collect and analyze data, make products, and share ideas. As in other complex learning environments, well-designed and scaffolded project-based investigation has the potential to help all students—regardless of culture, race, or gender—engage in learning.

In work at the University of Texas at Austin with teacher-learners, we have combined attributes of both anchored instruction and project-based instruction. Within

our program, teacher-learners are supported in creating an initial challenge, or anchor, video, and then in placing that anchor within a 6- to 8-week, student-created, project-based unit.

In our version of project-based instruction, students use a wide variety of software to develop project-based curricular units that are infused with technology. Software applications allow Web authoring, video editing, concept mapping, and modeling. Units produced by students are posted to the Web and copied onto a class CD so that students have access to a library of projects (see http://www.edb.utexas.edu/anchorvideo/).

A major hurdle in creating project-based curricula is that the process requires simultaneous changes in curriculum, instruction, and assessment practices—changes often foreign to the students as well as to the teachers. In our program, teacher-learners design, implement, and evaluate project-based curricula in collaboration with their cooperating K–12 teachers and university researchers. Previous work has identified four important design principles for this type of instruction; (a) defining learning appropriate goals that lead to deep understanding; (b) providing scaffolds such as beginning with problem-based learning activities before completing projects and using "embedded teaching," "teaching tools," and sets of "contrasting cases"; (c) including multiple opportunities for formative self-assessment; and (d) developing social structures that promote participation and revision (Barron et al., 1998).

Although all four goals are important, the development of a quality anchor video most satisfies the first design principle and also paves the way for the other three design principles. This course has many innovative aspects, but the most salient for the immediate issue at hand is the design, development, and incorporation of student-created video anchors for their project-based units.

Over the past 4 years, project-based units have been developed in such diverse areas as energy expenditure of muscles during exercise, oil spills, habitats of Austin area bats, chemical bonding, virus transmission, and mathematical modeling. All cases have incorporated a set of design principles for creating a motivating question. These design principles have been informed by the work of Krajcik as well as the CTGV. Criteria for a quality "driving" question (Krajcik et al., 2002) include issues of whether the question is (a) worthwhile (i.e., promotes higher order thinking), (b) feasible (i.e., students can design and perform investigations to answer the question), (c) contextualized (i.e., related to real-world problems), (d) meaningful (relevant to learners' lives), and (e) open ended (a complex problem with multiple solution paths). Design principles for the creation of the anchor video include a narrative structure to the story, a generative design to the story that allows the user to develop their own problem-solving strategy, embedded data, a complex problem involving multiple steps to mimic real-world problem solving, and the use of digital video to make the complexity manageable (CTGV, 1990; Goldman et al., 1996).

We now take an example of one student-created video and show how the students employed these design principles. The project we look at examines how viruses spread. In the words of one student group, their project addressed the design principles of a driving question in the following way:

> The students will be able to perform and sustain an experiment where they are controlling the factors so that they can observe and report their data. The investigation allows the students to infect the plants with the tobacco mosaic virus. It allows the students to perform and sustain an experiment where they are controlling the factors, so that they can be the ones to report and observe their data. This driving question is anchored to what is a real world situation. Virus spread is a topic that is found in every state, nation, country and continent. It is something that does affect our daily lives…Meaning is also important to a successful driving question … Understanding the importance of vaccines can become interesting for those students who know of people who are not vaccinating their children. Learning about past epidemics can lead to great insight of our technological advances. The driving question has sustained inquiry. The students are constantly challenged on learning new material and being able to present it as well. The investigations we have included in the unit require collaboration from the students so that they have success in their investigation. The students will be able to create their artifacts so that their knowledge on this subject does sustain. The investigation leads to a great sustainable driving question. The students can go into great details and pursue the answers over a long period of time.

An examination of their anchor video shows the incorporation of a narrative.

Story—various clips of people addressing the impact of harmful viruses in their lives, including farmers, sharecroppers, and lovers. Multiple pictures of viruses are embedded in the video along with text fields that pose problems to the students. The video presents the problem in such a way as to make it obvious that solving a problem like the spread of a virus is very complex because it mimics other diseases and is often disguised or invisible to the novice. The use of digital video assists in managing the complexity of the problem.

Students not only design, film, and edit their own anchor video, but also develop a 4- to 6-week curriculum consistent with state and district standards. Over a single semester, students are exposed to and eventually produce their own project-based units. Furthermore, during their 10-week student-teaching semester, students are given the opportunity to enact the project-based units they developed with their partners. We believe this gives our teacher-learners an amazing head start to reflect on their own understanding and ability to enact complex instructional pedagogy while very early in their careers.

EXAMPLE 2: CASES OF LITERACY INSTRUCTION

Michigan State University has a long history of researching, advocating, and implementing case-based approaches to the professional development of future teachers (e.g., Lampert & Ball, 1998; Sykes & Bird, 1992). In TE 401, an elementary education methods course, Dr. Cheryl Rosaen had used case materials and videos of classroom teaching (e.g., Lampert & Ball). Together, Rosaen and Koehler worked to engineer some classroom experiences that would:

1. Help the teacher education students connect what they were reading about to actual classroom practices.
2. Make students' thinking visible and on the table.
3. Help students learn and understand the content area (early grade literacy instruction).
4. Help students learn to be thoughtful, reflective, and analytical about classroom teaching.

The approach combined elements of a case-based approach, exploring video anchors, and student authoring. Using IVAN (2003), a system designed at Michigan State University, students are presented with a library of video clips and linked commentary to a case representing a wide variety of examples of literacy instruction for a single teacher (multiple IVAN cases cover different teachers in different grades). Students can view any segment of the library, read materials that go with the video segments, and even follow Web links to external sources (see Fig. 26.1). Students also can mark portions of any video they see and easily place that segment on the time line, in essence allowing them to make their own movie, case, or video anchor out of the larger video library. They also can write commentary that is linked to specific portions of their time line (video anchor).

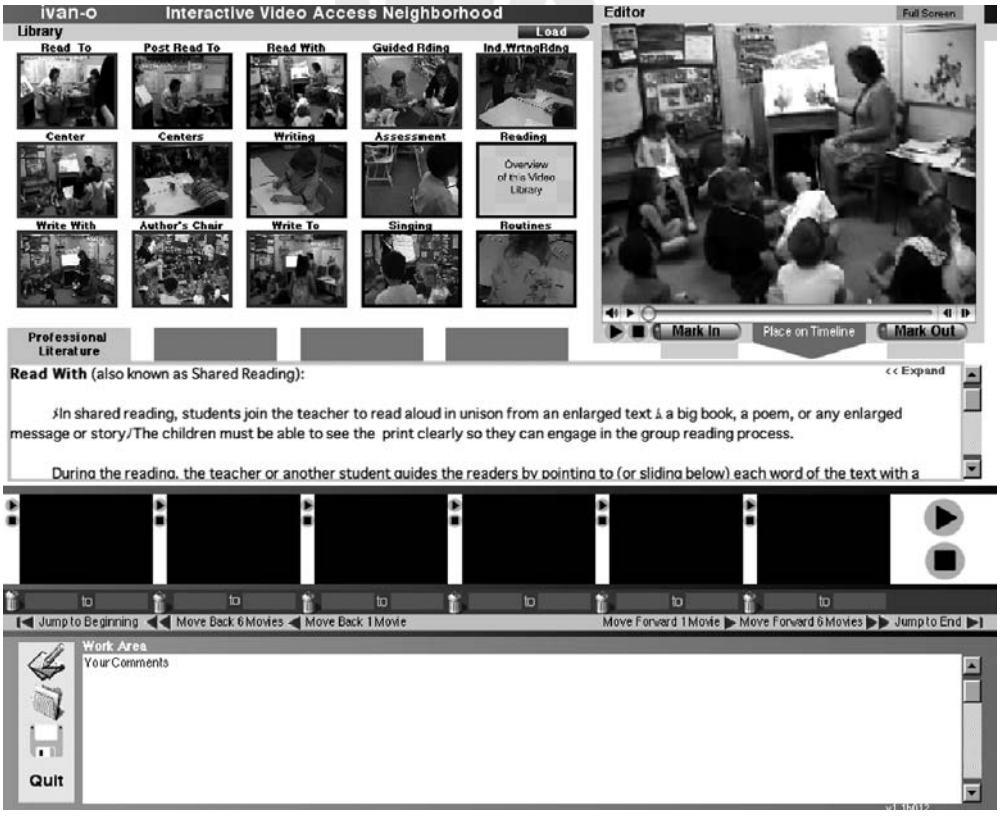

Figure 26.1. Example of IVAN interface for teacher-authored videos.

Using this interface, students receive task-specific instructions for their video authoring, in groups or as individuals (depending on the constraints of time, computer resources, and task for the day). In one example, students were asked "to explore how reading skills and strategies are taught and learned at that grade level … to create a timeline that includes at least three excerpts." In addition, students were asked to write linked text to connect their video exploration with concepts and terminology used in class and in the reading assignments. Specifically, for each segment they chose, they were to explain (a) the stage of the reading process, (b) specific reading skills and strategies being taught, and (c) any questions they had about this clip. Students also were asked to document any "aha! experiences" as they completed the assignment.

This approach has several advantages. The instructor has the opportunity to see how well students are making connections between theory (their readings) and practice (the videos). The class shares the multiple (and varied) understandings and perspectives brought by different groups. It also has been our experience that the activities are very engaging to students, and they report the activity to be a valuable source of learning not available through the text alone. Fruitful class discussions also follow, as groups show the segments chosen by each group, discuss their thinking, explore any questions, and discuss any commonalities and differences among the groups' works. This allows students to think about and discuss video from grades their specific group did not see and to discuss how (or if) literacy instruction differs between grade levels.

Anchors are used in two ways. First, the library and task structure provide a form of anchored instruction very similar to that provided by Jasper. Students receive an authentic context, work on an open-ended and semistructured problem, are situated in video, work collaboratively to reach answers, and engage in extended inquiry. Second, the task makes use of anchors because in the process of creating their own time line, the students design their own form of anchored instruction for their fellow classmates. The student-authored time lines serve as "mini-anchors" for the ensuing classroom discussions (and other possible uses of the products we have not explored yet).

This approach also connects strongly to the literature on case-based instruction. By combining the best elements (and benefits) of case discussions (see Lundeberg, Levin, & Harrington, 1999, for a review of the topic), case authoring (e.g., Shulman, 1992), and case analyses (e.g., Harrington, 1999), this approach asks teachers to engage in the kinds of reasoned decision making (Toulmin, Rieke, & Janik, 1984) that they will be asked to do as teachers.

Additionally, students ask questions that they might not have voiced without the opportunity to explore activities through video. For example, one teacher education student wrote that one advantage was recognizing that second-grade students are making different connections than the one you are trying to teach. I can see how it would be easy to overlook statements that may seem to be disruptive or not pertinent to a discussion.

That is, what this student took as good teaching—a clear transmission of ideas to students—was challenged by her work in the IVAN cases. Initially she saw a teacher doing this kind of instruction, and saw children's responses as disruptive behavior. Later, she saw that it was possible to see children's responses as indicators of possible connections to alternative understandings children were constructing (some of them were misunderstandings). Aha! moments are perhaps the most rewarding experience in this

approach—they represent times in which the material suddenly came together, suggesting it was not well understood before using the IVAN case. We are currently conducting studies exploring the effectiveness of this approach compared to other models of instruction.

EXAMPLE 3: TEACHERS AS FILMMAKERS: USING iVIDEOS TO LEARN ABOUT EDUCATION AND TECHNOLOGY

At Michigan State University, practicing teachers come to the master's program in educational technology hoping to learn technology skills that will enrich their teaching. Teaching educational technology is no easy task, as it requires careful identification of what teachers need to know about technology (see Zhao, 2003; or Mishra & Koehler, 2003, for a full discussion). The challenge is not to teach specific skills that are soon obsolete as hardware and software change. Moreover, students in our program cut across every conceivable grade level and content area. So, it is not simply a matter of helping teachers teach with technology in, for example, high-school mathematics. Instead, we argue that the goals of educational technology courses should be the following:

1. Learn technology skills and concepts that are likely to persevere beyond the newest version of hardware and software (e.g., the concept of a file format—gif, .jpg, etc.).

2. Appreciate the reciprocal relationship between teaching and technology: Technology changes what students can teach and how they can teach it. Likewise what (and how) students teach impacts the technology used.

3. Teach students "how to learn" about technology. To relieve teachers from becoming constantly updated (and retrained) via workshops, teachers would do well to learn how to learn a new piece of technology on their own (or with colleagues). This means learning that failures, trying out new ideas, exploring interfaces, and consulting other resources are part of the process.

4. Encounter technology in authentic contexts in which multiple technological and educational concepts are tied together.

5. Encounter new ideas in education. What is the point of an educational technology program in which students learn nothing about education?

One way we have tried to design learning environments that foster these kinds of educational technology learning is a series of design tasks (see Koehler & Mishra, in press; and Mishra & Koehler, 2003, for a fuller description of the design philosophy). In one of these design activities, we have teachers collaborate in groups to produce iVideos (idea-based videos) that communicate an idea of education importance to a wider audience (Wong, Mishra, Koehler, & Siebenthal, in press). The videos should inspire others with passion for the idea. For example, in a capstone course, we asked

teachers to complete a 2-min iVideo that completes the following sentence: "Teaching is _____." Instead of teaching teachers how to do digital video, the teachers had to learn the technology in the context of communicating a broader educational idea.

We typically devote a good portion of the semester to working on iVideos, as groups work to organize their thinking, storyboard, and idea; begin to produce and edit their video; get feedback on the message they are trying to convey; and then cycle back through this process. In making an iVideo, students confront a lot of issues:

1. Learning about technology. Students learn a lot of key technology concepts and ideas, including file formats, client and servers (as they move files around to share pieces), Web pages and servers (as they share their work), the ins and outs of video editing and formatting, and the ability to play with technology (they are given very little explicit instruction on how to use cameras or editing equipment).

2. Learning about education. In producing an iVideo that completes the sentence "Teaching is _____," teachers have to wrestle with what constitutes good teaching, what their teaching philosophies are, what that philosophy looks like in practice, and the extent to which these values are shared and encompassing.

3. Learning to learn. Teachers are used to learning about educational technology by attending workshops. In the iVideo approach, students learn skills in context, as needed, by themselves (or with the help of other teachers). They learn that learning with technology means unexpected troubles (technology can drive you nuts), but more importantly, how to work through those troubles. They soon appreciate that they do not need a learned other (the instructor) every time they have a question. Instead they can figure things out by themselves, from a classmate, or from a Web site. In short, the process tames the fear of learning about technology.

Working with iVideos has, of course, other advantages (cooperative learning, learning to express ideas, etc.) that cannot be fully described here (see Mishra & Koehler, 2003; and Wong et al., in press, for further details).

In essence, asking teachers to create an iVideo is asking them to create a video anchor. Doing so requires a lot of learning, collaboration, organization of knowledge, vision, and hard work. It has been our observation (Wong et al., in press) that the process of making this anchor alone is worth the experience. Furthermore, teachers absolutely love the experience and are highly engaged and extremely proud of their work (they will show their video to just about anyone who will watch). We have found the anchor itself is worthwhile as well. As students preview their work in progress to the class, we have found very engaging classroom discussions to be the norm—the ideas raised in the video are fruitful grounds for discussion that we seldom can evoke through a good reading. We have also found these anchors to be very useful in other courses as catalysts for discussion; as appropriate topics arise in our PhD courses, we sometimes use the master's students' iVideos to initiate discussions.

THE LEARNING AFFORDED BY TEACHER-AUTHORED VIDEO ANCHORS

Although we have presented three different examples, there are common themes that arise across our approaches to the use of teacher-authored video as a means of learning for our teacher preparation candidates. Each example is consistent with the goals of anchored instruction. That is, each uses video stories to situate learning in an authentic context to serve as a bridge between the theoretical knowledge (that is often covered in a methods class) and the practical knowledge of expert teachers. Furthermore, these anchors serve as a point from which to learn content (i.e., subject matter). For example, to author IVAN time lines about best practice literacy instruction, students learn about literacy concepts and how to apply them. In all three examples, the anchor also embeds opportunities to talk about pedagogy, and what makes for good instruction.

The three approaches we have presented represent promising approaches to the development of in-service teachers. Although we are currently in the process of conducting more formal research studies, we are encouraged by our anecdotal observations of the classrooms, and the results presented by the work of similar scholars. For example, in one study, teacher candidates who used digital video tools to augment their classroom placement observations outperformed control groups in measures that required them to identify, to interpret, and to analyze evidence of exemplary teaching (Beck, King, & Marshall, 2002). We see the use of developing and designing anchor video as an effective means to help preprofessional students organize their knowledge.

Because teacher education students are the authors of the video anchors, we have also seen a re-energized teacher-education classroom. We feel that in a more traditionally designed curriculum, teacher education students have lost ownership, responsibility, and voice in the curricula process. However, in all of our examples, and many that we have experienced but not reported in this chapter, prospective teachers have all been highly engaged and motivated in curricula design, in their own teaching, and in student learning. All students want copies of their iVideos and video anchors to show their family, friends, and colleagues. This desire or pride by the students is not evident in any other assignment we give to the students throughout the academic year.

Unleashing the power to be creative as well as a thoughtful and reflective professional seems to be a great leverage point for their professional education, leading to a sense of community, shared goals, and the development of collaborative skills (Petrosino & Dickinson, 2003). Also, there has long been a call for teachers to integrate technology into their own teaching (Mishra & Koehler, in press; PCAST, 1997; Zhao, 2003). The use of anchor video is a specific example of integrating technology into their own learning, which, when combined with its motivating effects, makes it much more likely to extend into their own teaching.

SUMMARY

This chapter presented three promising approaches to integrating digital video tools with pre and in-service teachers to support their development as instructional de-

signers and reflective practitioners. Despite the differences in goals and implementations inherent in these three examples, together they afford opportunities to accomplish many of the goals of anchored instruction—that is, they encourage future teachers to pose and solve complex, realistic problems that bridge the gap between theory and practice. To be sure, teaching structured around teacher-designed video comes with challenges: Technology comes with its own set of costs in time, money, and potential frustrations; faculty have to buy in to this different model of teaching; and time spent doing these activities is time taken away from other instruction.

Extensive assessment and evaluation must be undertaken to see how this approach impacts in- and preservice teachers' cognition and (more importantly) the understanding of their students. However, the process we have begun has emerged from a sound research base, and such studies should provide insight to the instructional design community as well as to the learning sciences.

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