Amplifying Autonomy and Collective Conversation: Using Video iPods™ To Support Mathematics Teacher Learning

Katherine A. Morris
Sonoma State University
& Joan Easterday
Sonoma County Office of Education

Mathematics teaching and learning are inherently complex practices, and we continue to see reports that suggest that American teachers are not as successful at teaching mathematics as we might hope (e.g., Gonzales, et al., 2004). In this article, we explore how a seemingly ubiquitous new technology—the personal audio/video player—just might help teachers improve mathematics teaching and learning. This article explores how the video iPod™, new on the technological frontier in teacher education, can be utilized to support teachers' learning in and from teaching practice. We begin by outlining affordances and limitations of various video-based technologies that have been used in mathematics teacher education over the last two decades. We then provide an illustrative case in which video iPods™ have been employed in a longitudinal professional development initiative designed to help 5th to 9th grade teachers improve their practices in teaching algebraic thinking to English Language Learners (ELLs). Herein we report how teachers use the iPod™ and what it enables them to do, and share our preliminary findings that suggest personal audio/video players can foster both greater autonomy in professional learning and greater participation in more rigorous professional development discussions, thereby creating increased opportunities for

Katherine A. Morris is an associate professor in the School of Education at Sonoma State University, Rohnert Park, California. Joan Easterday is program coordinator for mathematics with the Sonoma County Office of Education, Santa Rosa, California.

teacher learning. The article concludes by looking toward the future, considering new ways of utilizing the technologies and posing questions for continuing research.

Changes in Teaching Mathematics and Mathematics Teacher Education

Fully two decades ago the National Council of Teachers of Mathematics articulated new standards including what, for many teachers, was a novel approach to teaching mathematics (1989). NCTM argued that all students needed access to mathematical concepts, problem solving strategies, and applications, not just a steady increase in mathematical skills and procedures through the grades. The standards also suggested pedagogies that were new to many teachers who routinely enacted more stereotypical U.S. math lessons—reviewing homework, teaching by lecturing at the board on a new technique, assigning problems to students for seatwork, correcting seatwork, and assigning homework that would be corrected the next morning.[1] Classroom discussions, open-ended and collaborative problem solving, the use of manipulatives and other mathematical models, and multiple modes of assessing student learning were new for many teachers. Teachers, it would seem, had much to learn.

Parallel to what was going on in mathematics classrooms in the late 1980s, a paradigm shift was underway within professional development and more broadly in teacher education. We too were shifting the focus away from transmitting knowledge. We were developing pedagogies and resources with which we could provide experiential learning opportunities that might guide teachers to examine their own content knowledge and teaching practices in a collaborative, problem-based setting (Louckes-Horsely, 1995). Spurred on by technological breakthroughs, mathematics teacher education began to see an explosion of videos that presented teaching strategies for and illustrative cases of conducting mathematical discussions, using manipulatives and assessing students' thinking (e.g., Burns, 1988; Kamii, 1987; Richardson, 1990). Since that time, mathematics teacher educators have routinely been at the forefront in developing ways to utilize emerging technologies to support pre-and in-service teacher learning (e.g., Fosnot, et al., 2003-6; Lampert & Ball, 1998; Seago, Mumme, & Branca, 2004). Within the field of mathematics teacher education, it is evident that we have taken up the theory that teachers can and do productively learn in and from a careful consideration of teaching practices (e.g., Ball & Cohen, 1999) and multimedia technology plays an increasingly significant role in helping teachers develop their capacities.

Technological Advances in Math Teacher Education

Since the mid-eighties, video technologies have been increasingly used to help teachers improve their practice through professional development. While perhaps counterintuitive, in many ways video-based representations of classrooms and teaching practices provide teachers with greater opportunities for studying practice than live, in-person observations (LeFevre, 2002). Among the many benefits of video materials, four are central to our work. First, video resources allow us to break down the barriers of isolation that are so prevalent in American teaching, enabling teachers to view the teaching of others without the logistical impediments that are often associated with peer observations (e.g., securing substitute teachers, time for pre- and post-observation conversations, follow-up planning and implementation…). Second, unlike in-person classroom observations, video resources enable teacher educators to be selective in what elements of practice will be studied by pre-selecting specific teaching/learning events and classroom artifacts (student work, texts, teacher's notes, etc.) and purposefully juxtaposing particular episodes and artifacts. Third, video resources enable viewers to slow down, stop, rewind, and replay the unrelenting pace of instruction—what Cohen has called "temporal enrichment" (in Lampert & Ball, 1998 p. 179). This makes it possible for teachers to examine the teaching and learning in greater depth, studying multiple elements of teaching practice that would be impossible in the immediate and rapid actions presented during classroom observation. And finally, when the same video resources are investigated by a group of teachers, they become *shared texts* that can support in-depth conversations about teaching and learning.

Video technologies for professional development have evolved significantly in the intervening decades. With the introduction and widespread availability of VCRs, in the mid-eighties math teacher educators began to take advantage of VHS videotape technologies. In the age of a new national mathematics reform, videos provided strong visual images of what is possible in a classroom. They demonstrated new tools and instructional innovations, providing existence proofs for the kind of thinking that students were capable of (e.g., Burns, 1988; Kamii, 1987; Richardson, 1990). In fact, some of the best videos introduced at that time are still used in methods classes and in-services to this day. VHS technology enabled a whole group of teachers to "visit" a classroom or "meet with" an expert.

The literature is clear, however, that an observation (real or virtual) in and of itself is not necessarily educative (e.g., LeFevre, 2002). The power of these tools was that the opportunity to "observe" was conducted

in the company of others and mediated by the teacher educator who could select elements of focus, stop the action to engage in a discussion, rewind for repeated viewing of a particular practice or dilemma of practice, and so on. Teachers might view an entire lesson or they might watch a short illustrative clip. Then there would be time for a group of teachers to interpret and discuss the teaching and learning practices they had observed.

Of course technologies have their limitations. With the VCR and VHS tapes, it was clunky to skip back and forth on the video and it was well suited only for group viewings. The nineties brought the next wave of technologies which included the development of CD-ROM based media that incorporated Quicktime™ and Hypercard/Hyperstudio™, and presented new opportunities to bundle video with other artifacts of practice including student work, teacher journals, assessments, etc. (e.g., Lampert & Ball, 1998). These more robust "records of practice" in turn facilitate new, more authentic ways for teachers to study teaching and learning.

We have witnessed a progression from VHS, to CD-ROM, to DVD as newer technologies have supplanted older ones. Figure 1 illustrates that as the technologies have advanced, there have been new features for teacher educators to exploit in support of teacher learning, and that each subsequent wave mitigates some of the prior limitations. Each new technology has afforded slight improvements in terms of quality and quantity of data, relative cost, mainstream access, and maneuverability, however, they did not radically change the ways in which teacher educators and pre- and in-service teacher learners interacted with these resources. Typically it has been the teacher educator who has controlled the remote control and thus controlled the way in which teachers interacted with the available materials. Even in recent curricularized video-based materials that include participant CD-ROMs, enabling teacher learners to interact with the resources on their own, experiences are typically guided by structured protocols that de facto control teachers' experiences (e.g., Fosnot, Dolk, Cameron, & Hersch, 2003-6; Seago, Mumme, & Branca, 2004).

The iPod™ changes all of that! While the content (audio, video, images, and texts) may be identical to what might be available on a CD-ROM or a DVD, the ways in which it can be accessed by teachers and teacher educators offers tremendous new advantages that we are only just beginning to explore and learn to exploit. With the iPod™ teachers can personalize their interactions with professional development resources in ways that would have been cumbersome at best using older technologies. Widely accessible software such as iTunes™, iMovie™, and Quicktime™ make it possible for teacher educators (and teachers themselves) to create and upload podcasts and video podcasts

Figure 1
Evolution of Video-Based Resources in Teacher Education.

VHS Recordings

- Whole group common viewing and/or individual cassettes.
- Strong visual image of complexities of teaching and learning.
- Rewind and replay to study for multiple purposes.

Limitations: Cumbersome to control / edit
Need special equipment for whole group viewing

CD-ROM Recordings

- Digital viewing with computer (enabling view to "skip to" timecode)
- Some editing capacity
- Improved picture and sound
- Increased capacity for ancillary materials

Deficiencies: Limited memory for storage of scenes
Limited accessibility to participants.

DVD Recordings

- Increased capacity for memory, chapterizing, and editing
- Multi-track commentary side-by-side with classroom scenes
- View with DVD player accessible to most participants

Deficiencies: Difficult to make DVD work cross-platform and for different operating systems.
With increased use, hardware requires more memory capacity.

iPod Recordings – video and audio

- Individually control rewind, replay, volume as needed
- Mobile learning on own time - independent of proximity to computer
- Immediate access of new postings through vodcasts / websites
- Accessible to larger audiences

Deficiencies: Technical support needed while learning to use new technology.

(aka vodcasts) for professional development participants to download and view and review at their own pace and in their own space, as well as within the professional development context.

Of course the iPod™ is not the only personal audio/video platform available to teachers and teacher educators. We utilize this specific brand because it is capable of presenting audio, video, and still images; it is a widely available, and easy to use for our participants; and it interfaces well with equally accessible non-professional-grade audio/video software which enables both the teacher educators and the teachers to create and can be uploaded. However, we do not mean to suggest that similar work in teacher education enterprises need adopt the Apple™ products nor that other brands could not be effective with teachers.

Nor do we mean to suggest that we are alone in our forays into the use of these emerging technologies with or for teachers. For example, in the area of literacy studies, teacher educator Vivian Vasquez currently produces a weekly podcast providing teachers and others with an on-demand weekly internet broadcast in which she explores topics in critical literacy practices in education (see http://www.clippodcast.com/ for more information). Mainstream media are also entering the arena of podcasting for teachers. For example, PBS now offers a podcast series entitled "TeacherCast" which are excerpts from the Newshour with Jim Lehrer that are of particular interest to teachers for their own professional development and/or use in the classroom (http://www/pbs.org/newshour/rss/podcast_teacher.xml). However, while these and many other such materials are designed for (and in some cases by) teachers, they are not designed explicitly for use in teacher education. In the next section, we present an illustrative case of a local professional development initiative in which we seek to utilize these new technologies in the service of teacher learning.

An Illustrative Case: Improving the Way We Teach English Language Learners Algebra

For the past three years, approximately forty upper elementary, middle, and high school teachers from five rural and suburban underperforming school districts in Northern California have come together as part of a multiyear California Math/Science Partnership grant designed to improve teaching and learning of algebraic thinking for English Language Learners (ELLs). In this report, we draw upon existing ethnographic data collected over the life of the project. These include: anecdotal reports from the participants, observations of monthly professional development sessions, small group facilitator syntheses, partici-

pants' public presentations, and participants' session evaluations. Our interpretations of the data were triangulated through member checks with participants, facilitators, PIs, and external evaluators.

The teachers in the project, (novice to near retirement) were recruited by the district liaisons. They have been working with us to learn to enhance their students' learning opportunities through mathematical discourse; supporting their students to move beyond merely providing a short yes/no or numerical answer or step-by-step explanation of procedures. Our aim is that the teachers learn to guide robust classroom discussions in which all students, even students who are learning English, have opportunities to make conjectures, justify their reasoning, evaluate strategies, use models and diagrams, and move towards generalizations and proof.

Grappling with how to meet the needs of ELLs is not new for teachers in our region, nor is it new for professional development initiatives to focus on helping teachers improve in this part of their instructional practice. However, increased pressure to improve test scores, coupled with policies that aim to have all students take algebra by 8th grade, have highlighted the fact that ELLs in our region (as in the rest of the country) consistently score lower than fluent English speakers on standardized tests and are underrepresented in middle school algebra classes.

Previous local professional development initiatives focused on helping teachers who work with ELLs build a repertoire of predictably structured questioning strategies to elicit student responses in a safe classroom environment and incorporate "sentence frames" (a form of cloze sentence in which certain sentence elements are provided and others left blank) in order to scaffold students' language production in math class. However, over time, we found that these structures were only getting teachers and students so far. While students were developing more vocabulary, and some of the linguistic constructions that are part of the mathematical register (e.g., Halliday, 1978), they were not developing the higher order thinking that the QUASAR project (e.g., Henningsen & Stein, 1997) found to be associated with middle-schoolers' success in mathematics.

Research suggests that leading robust classroom discussions is complex work, even in fairly monolingual classrooms (e.g., Lampert, 2001; Mendez, Sherin, & Louis, 2007; Sherin, 2002) and guiding that participation is all the more complicated when those who are to engage in the discussion are not fluent English speakers. Moschkovich (e.g., 2002; 2006) has articulated just how important it is for teachers to understand the relationship between mathematics and language as they design and implement mathematics instruction for ELLs. The adoption of a sociocultural perspective on language and language learning pushes teachers and teacher educators to move beyond a deficiency model for language

acquisition by recognizing the linguistic and mathematical resources that ELLs bring into the math classroom. Current research emphasizes the centrality of EL students' opportunities to negotiate meanings through participation in mathematical communication with peers and teachers (e.g., Moschkovich, 2006; Turner, Dominguez, Maldonado, & Empson, 2006). The research provides evidence that students do not need to master the vocabulary and language structures before engaging in mathematical reasoning. Rather, students who may have smaller or less accurate vocabulary can and do learn mathematics simultaneously with language when teachers appreciate and utilize students' mathematical ideas. Despite linguistic limitations, they need opportunities to contribute to, make sense of, and extend mathematical ideas with their peers and teachers while they are doing mathematical tasks. In other words, not only do students have greater opportunities to learn mathematics when they are actively engaged in rich tasks that call upon them to receive and present ideas in multiple ways, and negotiating meaning with others, they simultaneously have greater opportunities to learn language in such contexts.

In retrospect it is clear that through our previous professional development initiatives, when we taught teachers to utilize sentence frames and focus on asking purposeful comprehensible questions that would help students develop their mathematical academic language, we overly structured the linguistic context of mathematics instruction. As a result, all too often, teachers were confusing situations/structures that helped students learn mathematical language with really "doing the mathematics" (e.g., Henningsen & Stein, 1997). In carefully (sometimes perhaps excessively) structuring the linguistic demands on students, teachers reduced linguistic complexity. They simultaneously were inadvertently reducing the complexity of the students' mathematical work. In effect, they reduced students' opportunities to learn both authentic language with its nuances and multiple meanings *and* mathematical thinking.

Thus, following Moschkovich's lead, our current project strives to help teachers learn about and learn to utilize the intellectual resources that ELLs bring to their 5th-9th grade math classes. We realized that we needed to help teachers learn to really hear what their students were saying mathematically, regardless of linguistic challenges including accents, missing words, and code-switching. And we use the iPods™ to do so. Each teacher in the project has the use of a video iPod™, and we have created a variety of downloadable resources for the teachers. The resources take the form of podcasts that are available via iTunes™ or directly through a local website. These fall into two categories: audio and video. The primary audio resources are *research articles* on classroom

discourse and ELL learning that have been read aloud like "books-on-tape". Video resources include: *classroom lessons* by local teachers, *ELL student interviews* on mathematical understanding conducted by the teachers before and/or following specific lessons, and *topic talks* by math teacher educators on issues such as collecting and interpreting rigorous evidence of student learning in the classroom.

Teachers in our project can access all of these resources at any time, in any place, but there are a few specific ways in which teachers are encouraged to utilize them. First, they are asked to prepare for professional development sessions by "reading up" on current research related to our foci (algebra, mathematical discourse, student learning, ELLs, and teaching that fosters higher order thinking). Second, during professional development sessions, they individually watch and analyze classroom videos and student interviews, as the basis for collegial discussions about content, teaching, and learning. And third, following a professional development session, they are encouraged to re-watch specific lessons and interviews in preparation for teaching comparable lessons in their own classrooms and interviewing their own students about their mathematical understandings.

Could teachers read articles and watch videos without the iPod™? Of course they could. However, we have found important and somewhat unexpected benefits for both teachers and teacher educators when we use the iPods™ to deliver the content. First, as anyone who has taught teachers before knows, they are very busy people. In the past, the professional development facilitators would carve valuable time out of a professional development session for "homework" because they knew that otherwise few teachers would carefully read or view what was assigned. With the iPods™, when we assign readings and viewings, teachers do them. Teachers report that the main reasons for the shift is that that they are able to multitask while engaging with these resources—listening to a research article while driving to work, watching a video while on the elliptical trainer, listening to a talk while preparing dinner… In fact, many commented that they watched/listened to excerpts of the content more than once. Weighing only a few ounces, with a 30+ gigabyte hard drive that can hold 40+ hours of video, and a battery life of between 5 and 30 hours (depending whether one is accessing video or audio content), iPod™ enables a kind of mobility far exceeding other technologies, even a laptop with a CD-ROM or DVD.[2]

Not only are the iPods™ enhancing teachers' utilization of resources outside of the professional development session, they are also changing the way teachers interact with resources *during* the session. As an example, in a recent daylong session, facilitators began as many

mathematics professional development sessions begin. They asked the teachers to solve a math problem—in this case, "What is 4 x 97?" Based on this problem, facilitators modeled a classroom discussion about computational strategies, relationships and representations based on that problem. They then debriefed the experience, highlighting algebraic elements of the mathematics such as the intuitive and informal uses of the commutative, associative, and distributive properties, as well as mathematical language and communication strategies that were used. As is often the case in professional development, the facilitators then provided an extended video excerpt from a math lesson in which this same problem is being solved and discussed by students—in this case, 5th grade ELL students. The teachers (especially the high school teachers) were amazed at how the students were using a wide variety of mathematically powerful strategies just as they had done; they empathized with how, like themselves, some of the students struggled to fully articulate their reasoning. However, in this case, one major element was very different—the element of autonomy in one's learning!

Each teacher, iPod™ in hand, selected the video excerpt, watched a segment, paused the video to think or take notes, or backed the video up to listen carefully to a particular student response, re-watching segments that were particularly salient for their own understanding and development. Without needing to interrupt the group's viewing in order to ask the facilitator to rewind for them—something that one can hardly imagine a teacher in a large group doing—teachers replayed the video at will. From time to time, teachers would lean into their neighbor and whisper something, wanting to discuss the video right away. A few worked together for longer periods of time. But by and large, the teachers worked independently as they viewed, analyzed, and interpreted the classroom videos. When they were ready, most went on to watch the vodcast interviews of students that corresponded with the lesson they had just watched. When the facilitators did reconvene the group for a discussion, teachers were immediately ready to talk about what they had noticed. As they raised questions or conjectures about the teaching and learning they had observed, individuals picked up their iPods™ and began to scroll through the video to look for evidence.

The combination of the content and the personalized technology required teachers to engage in the resources individually and actively. They could not be passive viewers. This finding was anticipated. What we had not expected was the extent to which teachers' autonomous investigations with the materials led to teachers participating differently in the subsequent whole group discussions of teaching and learning. Our findings suggest that the individualized preparation had an impact on

two important aspects of the whole group discussion. First, compared with similar conversations the facilitators held previously (with this and other groups), the teachers sustained a more in-depth discussion than would otherwise have been possible; and second, based on observations by participants, facilitators, and observers, more teachers played an active role in the discussion. The teachers discussed the flexibility they observed in the thinking of these local 5th grade ELLs, and began to consider why they were not seeing that same capacity in their own ELL students, especially as they moved through middle and into high school. To the facilitators' delight, as they started to discuss ways in which teachers might begin to bridge the gap and tap into the students' mathematical and linguistic resources, they articulated specific and cogent connections between the research articles they had "read," the simulation they had experienced, the video of a local teacher they had just viewed, and the practical dilemmas they faced in their own teaching contexts.

Because this handheld device contained the readings, the talks, the videos, and the interviews all at the flick of a thumb, the teachers made very specific and grounded points, linking these various written and oral texts, juxtaposing elements of the texts in interesting ways. At any moment a teacher might pick up his iPod™ and scroll to a particular point in a video, pop in his earbud, and listen for a moment to help clarify a thought, or bolster or refute a peer's comment. Throughout the discussion, many teachers made use of this technological affordance. The "intertextuality" (Floriani, 1993), the back and forth negotiation in which the teachers used various texts to co-construct shared local meaning, provides us with evidence that both individually and collectively, the teachers were making sense of the content that had been presented. There was a tacit understanding that each teacher was accountable for making sense of what was being discussed and that it was appropriate to refer back to the iPod™ to do so.

As the session proceeded, the facilitator too could prompt teachers to go back into the classroom video or the interviews. For example, at one point, the teachers were asked to watch what the teacher in the video said and did as he effectively scaffolded an interaction in which an ELL student justified his thinking. The teachers purposefully re-viewed the video, trying to analyze the talk moves (e.g., wait-time, revoicing…) the teacher incorporated at particular junctures in a student's explanation. They were given a transcript of that section of the video, and asked to make note of points when the students engaged in higher order thinking, and then analyze what the teacher had done to support it. For many, this work served as an existence proof that ELLs could, in fact, express higher order mathematical thinking, and it enabled the teachers to have

a rich conversation about very specific teaching practices that supported student expression. The conversation was peppered with shouts like, "Hey everyone, scroll to 23:14. This is where the teacher prompts…"

It is worth noting that while these facilitators have often used transcripts alone to push teachers to consider specific discourse moves that help students express their thinking, here again the inclusion of the video that each teacher could autonomously control seemed to lead to far greater participation in a more rigorous conversation. Furthermore, the video played a particularly important role when considering classrooms with ELL students. That is because with a transcript alone, the reader loses much of the meaning that ELL students convey through routinely inaccurate, and highly deictic speech that is often laden with gestures (e.g., Moschkovich, 2006). Armed with both a transcript *and* a video, the participants have much greater access to what an ELL student may have actually understood or struggled with. When the teachers made claims about what a student seems to know, or be struggling with, we find that they are far more prepared to answer when the facilitator asks, "What is your evidence? How do you know?"

For us, this is evidence that the iPods™ are enabling the teachers to develop a more nuanced understanding of what constitutes student learning/growth and capacity to recognize it, coupled with an understanding of teaching strategies that can elicit rich student responses that can render student learning visible. We are hopeful that such learnings, both through our on-going project and beyond, will continue to blossom in the teachers' own classrooms.

Conclusions

Opportunities for learning are those in which the learners are offered a "chance to interact with information and make sense of it" (Tuyay, Jenning, & Dixon, 1995, p. 76). Because the iPod™ augments teachers' opportunities to interact with the information, and in fact enriches their opportunities to interact with each other, we are finding it is enhancing teachers' opportunities to learn in and through practice. We see more of our teachers participating in longer conversations with specific and intertextual references to the multimedia texts; and even more importantly, we are seeing evidence that more teachers are engaging in the studied practices in their own classrooms.

We find that, when loaded with meaningful content, our teachers took advantage of their iPod™'s mobility and small personal size. Both within and beyond our project's professional development sessions, individually, in pairs and small groups, and during whole group discussions,

teachers autonomously viewed and reviewed the resources, making use of the resources as they worked toward our shared goal—improving teaching and learning practices that support English Language Learners to develop algebraic thinking.

The technology enables us to build upon the growth and strengths of our local teachers in ways that were previously untenable. The next step in our project is to build on the content teachers have already experienced—engaging ELLs in justifying their algebraic thinking. Teachers have begun planning and videoing their own lessons targeting ELL support for justification. Captured video clips provide evidence of student thinking that serves as the basis for teacher inquiry projects into teaching strategies that result in effective mathematical discourse. These inquiries and tentative findings/insights will be shared among project participants. Without taking anything away from the instructional capacity of many of the high quality published multimedia resources in mathematics education, we feel strongly that the local and collegial development of resources enables us to meet the immediacy of the classroom demands of our teachers (and bypass the "but *my students* are different" line of resistance that is often in the air during professional development). Hearing familiar voices of local students, many with accents and inaccurate wording, thinking algebraically and explaining their reasoning, helps teachers realize what they and their students might be capable of accomplishing and supports them to build on each other's accomplishments.

Within our specific professional development foci, we are finding that certain aspects of practice, such as the ways in which the teacher's questioning scaffolds students' explanations, or the language an ELL student uses in explaining his/her current understandings of a mathematical process, truly merit multiple viewings over time. In response, we are working to develop purposeful analytic tasks to guide teachers in their inquiry into such discourse practice. For example, we are experimenting with having the teachers analyze particular video excerpts using research based rubrics for analyzing teachers' and students' mathematical discourse (e.g., Hufferd-Ackles, Fuson, & Sherin, 2004; Turner, Dominguez, Maldonado, & Empson, 2006). We believe that asking teachers to use such analytic protocols will be productive for their learning. However, we do not yet have strong evidence that this is impacting classroom practice by changing the kinds of questions teachers are asking their students or their role in facilitating students' opportunities for engaging in higher order conversations. We know that we need to be alert to the possibility that (as in our previous professional development initiatives to support ELLs) teachers might begin to over-utilize particular teach-

ing strategies, thereby teaching the structure as an impediment rather than a scaffold to more authentic mathematical thinking by students.

A persistent challenge is to make reasoned decisions about what resources to upload for the teachers, because the fact of the matter is that just because we can continue to add to our archive, does not mean we should. Too much content would be nothing more than a blizzard for the teachers. At present the teachers have all interacted with basically the same lessons, interviews, talks, etc., and thus they are able to have highly intertextual conversations in which they can co-construct collective interpretations of the materials. As the technology advances, and "storage" becomes both cheaper and smaller, we run the risk of loading up the iPods™ with more and more content just because we can. Is more better? And if so how much? Of what? We sense that there is some point of diminishing returns, because the sheer quantity of classroom records will diminish teachers' ability to focus and forge shared understandings of the resources at hand, but just how much is an important question for future research.

It seems logical to assume that professional development in other subject areas might find similar benefits from using the personal audio/video player, especially as a tool for improving teachers' facilitated capacities for fostering classroom discourse—science teachers using iPods™ to study how to improve student engagement in experiments, English teachers studying writer's workshop. The player would offer these content teachers the same advantages for fostering autonomy and participation. Furthermore, as these devices become even more ubiquitous, teacher educators will develop ways to incorporate their usage into pre-service teacher education as well. With all the promise, however, we need to remember there is much we do not know, and that as soon as we think we do know something about using technology in teacher education, the technology itself changes.

Our video iPods™ were cutting edge when we purchased them and began developing professional development resources for our teachers in 2006. However, in less than two years, what was only recently state-of-the-art, is now called the "iPod classic™." Apple continues to introduce and improve upon new products such as the "iPod touch™" with capacities we have not begun to explore for our purposes in teacher education. New features such as a "stretchable screen" for zooming that makes viewing student work on a very small screen reasonable, and internet browsing have the potential to enhance our work. Our project, like most of its size, lacks funds to refresh hardware as soon as the next new thing is available, but as colleagues become new implementers, they will have new opportunities to capitalize on the inevitable advancements and

begin to answer the challenges that new generations of hardware and software bring. Though it may feel like trying to capture lightning in a jar, it is, nevertheless, important that as a field we learn to generatively study the use of technologies that may well be obsolete before the ink has dried on papers that report findings and provide warrants for its usefulness. We need to do so because the tools are out there and it is up to teacher educators to continue to make wise choices about how to best utilize them to create meaningful learning opportunities for teachers and their students.

Notes

[1] Sadly, studies have shown that these patterns of instruction are deeply embedded in our cultural models and are resistant to change (e.g., Stigler & Hiebert, 1999).

[2] Note that as of September 2008, iPods™ newer than those our participants are using can hold upwards of 40 hours of video with their 32 gigabyte hard drives.

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