OPENING WINDOWS ONTO CLASSROOMS:

PROMISES AND CHALLENGES IN THE DESIGN OF VIDEO CASES FOR PROFESSIONAL DEVELOPMENT IN MATHEMATICS AND SCIENCE

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I. A Conference on Video Cases

As teachers develop their craft, they are "like ballerinas without mirrors"[1] – walled off from observing themselves or accomplished colleagues. Reforms in mathematics and science education[2] make severe demands on teachers, asking them to deepen their content knowledge and master instructional approaches they have rarely seen or experienced. If teacher quality is central to student learning,[3] how can teachers develop new practices when they develop their craft in isolation? One strategy is to open windows onto teaching and learning through the use **video cases of classroom practice** as a resource for teachers' professional development.

In February 2002, a group of researchers and professional developers gathered at the BSCS offices in Colorado Springs to reflect on the potential of video cases to foster teacher learning.[4] These cases are part of a broader effort by NSF and others to support development of curricular materials and resources for professional development purposes. Just as teachers need high quality resources for their students, professional development providers need high quality resources to support their efforts to enhance teacher learning. The creators of the video case projects discussed at the conference are, in effect, conducting educational "design experiments" that are focused on the problem of how to build useful professional development resources using video cases of classroom practice.

Three producers of video-based professional development demonstrated their work as examples that could serve as a focal point for conference discussion and reflection:

- ♦ Video Cases for Mathematics Professional Development project, led by Judy Mumme and Nanette Seago;
- ♦ LessonLab software platform for videos from the TIMSS-R Video project, led by Jim Stigler, Stephen Druker, and Kathy Roth; and
- ♦ Video workshops produced by Harvard-Smithsonian's Center for Astrophysics for the Annenberg/CPB project, led by Nancy Finkelstein.

Other producers attending the conference also presented snapshots of their work with video. The conference also included professional development leaders who were active *users* of video-based professional development resources. *Funders* who are investing in the development of video-based resources also participated. [5]

Four questions framed the group's discussion:

- ♦ What goals are driving the development of video cases for teacher development in math and science?
- ♦ What theories and beliefs underlie the design of video cases?
- ♦ What design challenges are inherent to the creation of video cases as professional development tools and curriculum?
- ♦ What are the characteristics of current prototypes of video cases, and what are their advantages and disadvantages?

This monograph captures the major ideas that emerged in the discussions and reflections of conference participants. Our hope is that the monograph can make a contribution to the research and development effort in which these projects are engaged.

**THE DEVELOPMENT OF VIDEO CASES:
EMPLOYING AN "R&D" APPROACH TO EDUCATIONAL
INNOVATION**

Video cases are an innovative resource for professional development. The creators of the video case projects discussed at the conference are, in effect, conducting educational "design experiments" that are focused on the design problem of how to build a better type of professional development resource (tools and curriculum) using video cases of classroom practice. Conference organizers see this kind of R&D process as an exemplary approach.

Those involved in the work of educational innovation – funders and designers alike – often lack the habit that other industries have of taking a structured "engineering" approach to innovation. If GM wants to build a new car, for example, designers and engineers go through a series of steps involving the following:

- Identification and clarification of the design problem to be solved or the challenge to be addressed
- Examination of current theory and of current practice
- Inventing design conceptions
- Establishing proof of concept
- Assembling and testing prototypes – often through many iterations involving analysis of successes and failures
- Beta testing and scaling up
- Large scale marketing, dissemination
- Ongoing refinement

This engineering approach allows for an iterative process of testing, knowledge building, and revision. Each step allows the product to evolve as well as contributing to cumulative knowledge of the product's overall value and effectiveness.

By contrast, education is a field where an engineering R&D approach has not become the standard approach to innovation. The developmental process around educational innovation is usually constrained by incomplete theories, shifting policies and short-term funding cycles, as well as public pressure to go to scale quickly. Often, educational innovators craft a version of their idea, which they and others treat quite immediately as final or near final. In best cases there is some formative field testing and revision, but it is not long before there is pressure "to scale up" the innovation for wide-scale usage.

II. WHY VIDEO? ITS ATTRIBUTES AND POTENTIAL

Designers of video cases work from assumptions – informal hypotheses – about what teachers need to learn in order to improve their classroom practice, and about the properties and best use of video (and video-related technologies) to foster the requisite learning.

Becoming a connoisseur of teaching

The *prima facie* argument underlying video case development is that to become competent and ever more skillful at a craft, one has to study many good examples of the practice of that craft. Just as the great athletes, artists, chefs, and doctors are practitioners of their craft, they are also students of their craft and become "connoisseurs" through expert analysis of others' work. Similarly, the0 hypothesis goes, becoming a knowledgeable analyst of classroom practice – a *connoisseur of teaching* – can help a teacher improve his or her practice. As one participant put it, "Professional judgment comes out of analyzing classroom lessons. "[6]

Becoming a skillful analyst of practice does not happen automatically; rather, the structuring of the teachers' interaction with video is an important part of the design of video-based professional development:

> Teachers don't have the skills for describing and analyzing instruction. It is just not enough to say to a group of teachers, 'Now here is a video, watch it and analyze it,' they don't know how to do that. They don't know what you are talking about.

> Videos are subject to many avenues of investigation and there is a temptation to discuss whatever people notice and want to explore. We have learned that these kind of open discussions can lead to unfocussed and scattered discussion lacking in depth.

Bringing images to the "blind"

Teachers are separated from one another by their classroom walls, which produces a condition that some call "lateral blindness," i.e., the inability to see and know others who are like oneself. A conference participant recounted the following anecdote that took place on a site visit to a school:

> I once asked a fourth grade teacher what the teaching was like at her school. She said, 'I can't really say. I teach my own class but of course it is hard for me to see myself teach. And I never have the opportunity to visit other classrooms because I am always teaching in this one. So if you have just spent half a day visiting classrooms in this school, then you

> know more about the teaching in this school than I do. What is the teaching like here, anyway?'

The great education ethnographer Frederick Erickson suggests that teachers can become more open to change when they observe other teachers and discover that they have found different ways to teach:

> Teaching has been such a secret local practice, that we always assume that what we have figured out how to do is the way it has to be. Seeing something that is really different from far away can open up the possibility that there are lots of different roads to Rome. That opens up, I think, readiness for inquiry to change that can be very powerful.[7]

Video cases, it is hypothesized, can take the blinders off teachers by opening windows onto the classrooms of others.

School principals are similarly "blind" to the supervisory practices of other principals. A group working at Educational Development Center (EDC) is designing a video series aimed at changing the ways principals observe and supervise teachers. Like teachers, principals need concrete images of exemplary administrator practice in reform context.

Studying the whole, rather than the parts, of practice

Teachers typically take courses on subject matter, *plus* workshops on teaching methods, *plus* courses on learning. The teacher is then left to assemble those separate strands into a coherent practice and teaching repertoire. In contrast, by studying cases of classroom practice, teachers are observing a complex fabric of content, method, and learning as it is woven in specific and natural ways in the classroom.[8] When video-taped instances of "whole" classroom practice are a focal point for teacher learning, the hypothesis goes, teachers can deconstruct and extract (rather than assemble) knowledge about the subject matter, the teaching of it, and the learning of it.

Making teaching analyzable

> Video helps to slow teaching down, and make it visible, and therefore susceptible to change.

Classroom teaching is ephemeral. The complex stream of conversations, actions, and interactions serve their purposes and then, unless they are documented in a medium that stores them, they are lost. The fleeting action of teaching and learning can be partially documented through written descriptions, through oral recounting, through audio-taping; however, video (with audio) is clearly a medium that can capture and

also "store" classroom action to a much richer, more complete, and more reliable degree than other means.

By stopping classroom action, video makes an instance of teaching an *artifact* rather than a transitory experience. An artifact is analyzable:

> Teaching is a largely hidden, implicit, cultural activity. One of the most powerful things about video is it brings teaching up to a level where you have to find labels for what you are seeing.

This essential property of video has made it an invaluable tool for research, especially comparative research, on teaching in the last few decades.[9] It is a short logical leap to having teachers study such artifacts for their own learning. Video enables teachers to examine the practices of teachers next door, or anywhere in the world – and to do so over and over. Seeing others' practices heightens teachers' awareness:

> One purpose of video is to see the alternative. When you start to look into other people's teaching, you start to recognize how you yourself teach. You say to yourself: 'This may be the way I have done it all along, but there is no rule that says I have to do it this way.' Looking at these videos, I can really challenge my perceptions, my assumptions on what good teaching is.

Making theories concrete

Researchers and reform activists call for "student-centered" or "constructivist" or "inquiry-based" teaching practices. This leaves professional development leaders with the daunting task of helping teachers understand these terms in practice. What does "inquiry" really look like when urban fourth grade students are learning about density? What is a classroom conversation like when students are asking most of the questions? How does a teacher know what knowledge a student is "constructing"?

Being able to observe instances of teaching and learning can help teachers make links between reform language and classroom realities:

> The idea of "shared language" is very important, because unless there is a shared language for talking about practice, there is no way to share professional knowledge about practice. So for example, in documents like the NCTM standards where teachers read words about what good practice might be, they all have very different images about what those words mean – unless we can bring those images into alignment with the actual practice that is going on in classrooms. We might think we all agree about what we mean by 'drill and practice,' but I think there are a lot of different things going on out there that different people call 'drill and practice.' The same thing goes for 'problem solving' and so on.

Distributing images of practice on a large scale

Video images are both storable and infinitely reproducible. The same video cases can be viewed on a large scale and at times of convenience to many different groups. This property of video – its ability to transcend time and scale – can help professional development leaders address the challenge of developing a "shared language" and "shared vision" across many teachers in a school or district:

> We have a lot of problems with people having very different sources of information for things. If you have some common experiences that you can use to build some of the essential understandings that need to happen in order for a district to focus and enhance teaching, I think video can play a role in that. You can be very intentional about the selection [of the images] so there is one common piece that everyone sees. For example, for the batteries and bulbs series in our district, when we refer to that, no matter who we talk to, whether it is the superintendent or the principal or whatever, they have all had that common experience and the understanding is very consolidated. I think video can help define what it is that we are talking about.

From a cost-benefit perspective, the advantage of video is that an investment in capturing high quality images pays off through the creation of continuing capacity for large-scale distribution of those images.

Building case-based professional knowledge

Cases play a key role in the preparation of business, legal, and medical professionals. Conference participants noted that the potential to foster shared language and vision on a large scale has implications for building a firmer foundation for teacher preparation.

> We [in American teacher education] lack a knowledge base. The first thing they do in Japan is go read the literature, and we don't have that kind of literature on teaching or teacher preparation. We have a kind of universal research literature and most of that is not very relevant to classroom teachers. So they have to learn the art and craft of teaching on their own. If they have to learn it on their own, then we really don't have a profession in a way, because we don't have something that is sharable, that can be used to improve teaching over time. We need to have not just a few cases, but lots of cases.

Strengthening professional consensus

Building a broad base of shared professional language and vision can make understandings of "good teaching" robust enough to withstand the shifting winds of policy.

> There is not a deep or consistent sense of what good teaching is, so it is very easy to get thrown off track by other agendas. About every four years, the target changes and it becomes hard to do professional development because of that. One thing that video can do is help [the field] come to consensus or consistency. If the videos really represent what teachers and teacher educators think – and I think they know what good teaching is, by and large – it can be solid and consistent, and we won't get pulled away from it.

Re-purposing video images

With the advent of digital technologies, video images are becoming even more re-purposable than they were when only tape and VCR were available. Images can be distributed via many avenues – tape, CD, DVD, television, the internet. Any amount of footage can be indexed and accessed in whole or in part in practically infinite ways – at any "grain size," in any order, as many times as anyone wants.

> A lot of people are repurposing video. The exact same video could be used for classroom management issues, or English language learning issues, or science learning issues.

The new digital technologies make images of classroom practice extraordinarily flexible and thus useful for multiple users in multiple contexts.

VIDEO CASE PROJECTS DISCUSSED AT THE CONFERENCE

The projects demonstrated at the conference reflect a range of design choices that take into account the main attributes of video.

VIDEO COURSES FOR TEACHERS

The **Science Media Group** (part of the Science Education Department of the Harvard-Smithsonian Center for Astrophysics) has developed a variety of professional development resources available through educational television, videotape, and the internet, funded by the Annenberg/CPB. The Private Universe Project (PUP), featured at the conference, includes interviews with Harvard graduates who find themselves unable to explain why it is warmer in the summer and colder in the winter.

Subsequent series from the SMG aim to impart key content ideas and to exemplify teaching practices in mathematics and science that are consistent with a "constructivist" vision of learning. The workshops consist of eight carefully sequenced one-hour videos designed to be used by teachers as a complete professional development course, with a modicum of cued facilitation. Teachers can access them on their own schedule in tape or television formats. There are supplemental facilitator guides. Although the A-CPB project continues to invest in refinement of its portfolio of video-based courses and workshops, its major interest is in widespread distribution and use of their products.

VIDEO-ENRICHED CURRICULUM FOR PROFESSIONAL
DEVELOPMENT LEADERS

► The **Video Cases for Mathematics Professional Development (VCMPD) Project** is developing several professional development "modules," each a series of eight 3-hour workshops, the first of which is "Teaching Mathematics: Developing Understanding of Linear Functions." The centerpiece of each workshop is a video case, or "record of practice," from which teachers are meant to extract core mathematics principles and learn about students' development of mathematical thinking. The video cases are one component of a professional development curriculum that includes problem-solving and discussion.

The video cases are designed for use by sophisticated professional development leaders, not for direct use by teachers. Thus, there is heavy emphasis in the VCMPD project on both the design of the video cases themselves and also the surrounding experiences that comprise the full professional development curriculum. There is also emphasis on the design of training experiences and materials for the professional development leaders who are using the cases, including PowerPoint slides, articles, a detailed facilitator guide, lesson analyses and transcripts, mathematician's commentary, and sample workshop agendas, discussion prompts, and homework tasks. The VCMPD project is in a prototyping and development stage, with a somewhat greater focus on use for research purposes than on eventual large-scale implementation.

► The **Educational Development Center (EDC)** has created "Lenses on Learning," designed for the professional development of school administrators. Using videotapes as a substantial component, the courses aim to help principals better understand and support mathematics and science teaching in their schools. EDC is seeking funding for a new series, "Images of Administrator's Ideas in Practice." Video cases and other materials – e.g., student work and principals' observation notes – will be published in CD format with accompanying articles, interviews, and other resources.

WEB-BASED TOOLS AND VIDEO IMAGES TO SUPPORT ANALYSIS OF PRACTICE

► The Third International Mathematics and Science Study (TIMSS) study generated video images of hundreds of classrooms from seven countries. When these are coded and indexed, project staff see this archive as contributing to a knowledge base of classroom practice. **The LessonLab + TIMSS-R Video** group is building an internet-based digital software platform that will enable teachers and others to view video cases of classroom teaching on line, select indexed images quickly, access information related to the lessons, structure their own reflection and communication apparatus around the images, and interact with the lessons either individually and collectively and at a distance.

The apparatus surrounding the TIMSS video cases is designed so that a very wide range of users – individual teachers, professional development leaders, teacher preparation faculty, and so on – can gain access to the images and can also structure, for themselves, a range of uses of the images. Other projects can also use LessonLab software to scaffold use of their own video cases. Thus, both the video cases and the scaffold are designed as flexible professional development tools that help develop teachers' capacities to analyze practice. The for-profit arm of the project, LessonLab, Inc., is in an R&D stage with the goal of scaled-up use in the education marketplace.

► Teachscape.com is a web-based company that supports platforms for on-line professional development for teachers. BSCS created the curriculum for **Teachscape: Science**. Videos of carefully selected exemplary classrooms are the centerpiece for Teachscape; the cases are meant to enable teachers to see the first NSES standard, *Science as Inquiry*, in action. Additional materials include content resources, teacher commentary, and student work. Teachscape is also set up to facilitate teacher study groups and discussions of the video cases.

► **Design in the Classroom**, uses web-based images of classroom teaching to portray and exemplify innovative middle school curricula for teaching design technology.

III. DESIGN CHALLENGES, CHOICES, AND TRADE-OFFS

Designers face the challenge of producing images of classroom activity and enabling teachers to interact with those images in such a way that teachers have fruitful learning experiences. Design decisions – each of which involves choices and trade-offs – have to be made around three broad dimensions of the design problem:

♦ The viewer
♦ The content
♦ The scaffold for use

Design challenge 1: Taking the viewer into account

"The student is not a blank slate" – this is perhaps the first principle of all teaching. Similarly, the first principle of video design is that the viewer is not a blank slate. Teachers come to videos with varying levels of knowledge, as well as predispositions to the watching of video and to participation in professional development activities. What have designers learned to take into account *vis-à-vis* what teachers bring to their viewing images of classroom practice?

The "couch-potato" syndrome

Typical television viewers tend to watch a TV screen passively and take in the content in linear fashion. Designers of video-based professional development, in contrast, want teachers to learn from the classrooms on the videos by observing them actively, analytically, and interactively.

> I notice that people watching long lengths of video go into the couch potato mode. All of a sudden, all of these ideas which they initially have get lost, they fall by the wayside, they can't be recovered. So I have been trying to look at a couple of key variables – we are trying to optimize teacher dialogue and minimize couch potato behavior. A variable that might affect that might be the number of ideas that a single clip has. We're trying to find what that range is, that bracket so that you can reach that sweet spot where you are getting a lot of ideas discussed without too many opportunities being lost.

The shared experience of conference participants suggests that teachers can productively view video in an active professional mode for between 3 and 18 minutes. Producers face the challenge of how to show enough classroom action to make the complex activity meaningful, but in a small enough grain size to avoid couch potato syndrome.

The inclination to judge

Teachers tend to make very quick judgments about the teaching shown on video, based on deep-seated values about pedagogy, kindness, equity, subject matter, and so on. If they judge a teacher's performance as good or bad, they may then quickly accept or reject the practice as a "model." If teachers judge that the students are similar to or different from their own (grade level, ethnic background), they tend again to reject or accept what they see. Hasty judgments bypass and obstruct analysis.

Teachers' tendency to judge signifies, paradoxically, their *lack* of experience at connoisseurship. Just as a spectator may judge that a baseball player is a "good" or "bad" hitter by watching an at-bat on video, a professional baseball player will be able to examine every relevant element of an at-bat and learn something important about the art and craft of hitting. The professional player knows hitting because he has observed it all his life (no lateral blindness from the dugout) and also because he is likely to be well-trained and deeply experienced in learning from video. Most teachers, on the other hand, have had virtually *no* opportunity to observe teaching, and *no* chance to study it on video – hence the tendency is to rush to simplistic dichotomous judgments.

> You have to make ground rules for the teacher participants. You have to explain that this exercise is not an evaluation process. And you have to teach people how to talk to one another about practice and about what they see on the video because they don't know how to do this kind of analysis and have this kind of conversation.

Designers of video cases attempt to address teachers' judgmental tendency by designing viewing tools and guides that foster an analytic focus on *what* is happening and *why*, rather than whether it is "good "or "bad." Some believe that at least as much design thinking and prototyping has to go into these tools as into the video cases themselves.

The power of video to evoke emotion

Teachers often have strong, immediate emotional reactions to video cases. Teaching is a highly personal act for teachers, so analyzing teaching entails personal risk – even for the teacher as observer and analyst of another teacher.

Teachers can also react emotionally when they see on video the large discrepancies that can exist between what teachers believe their students are learning and what students can actually express at the end of a lesson. A video of Harvard seniors' misconceptions about the seasons is just one example:

> This little 18 minute video turned out to be very influential and had a pretty deep effect on a lot of teachers who were kind of taken back by it. Of course the first reaction when people saw A Private Universe was, well that is those students, but it is not my students. But they would go back to their classroom and ask their students some of these same questions and find, well yes indeed, their students had these misconceptions as well. Then there was a level of frustration. So now you have shown us this powerful piece of video and we are convinced that maybe we are not teaching what we think we are teaching. But what are we going to do about it?

The teacher-as-viewer is a major dimension of the design challenge because teachers are seeing something they are unaccustomed to seeing – real classroom practice – and are being asked to do what they are unaccustomed to doing – analyzing practice as a source of knowledge about teaching. The challenge of this dimension may perhaps diminish over time if video becomes a more pervasive, more "normal" medium for teacher learning.

Design challenge 2: The content of the video

Even within the general realm of "instances of classroom teaching," the choices of what to include in the video are many. What topics within the discipline will the teacher and students in the video case be working on? What unit of instruction will be portrayed? What will the teacher be doing? the students? What will the camera focus on?

Defining a learning purpose

There is little certainty among video developers about how teachers gain knowledge and develop their connoisseurship of practice within the framework of mathematics and science reform. Nonetheless, defining a learning purpose is a critical step in decision-making about what to show teachers. These are examples of learning purposes that shape designers' choices about what to show to teachers:
- to develop teachers' analytic skills and a shared vocabulary about teaching
- to exemplify what an education theory or reform model looks like in the classroom
- to reveal student thinking and learning
- to impart content knowledge to the teacher-viewer
- to illustrate what teachers go through when they change their practice
- to compare and contrast alternative teaching approaches

The unit of instruction

The *lesson* is the unit of instruction that seems most suitable as the focus for video-supported professional development. When a small portion of a lesson is shown on video, which is typical, it is contextualized as part of a lesson.

> The lesson is a really good unit to think of as a unit for professional development for several reasons. It is a self-contained unit, teachers tend to think of their work in terms of planning out lessons, and it is broad enough, yet deep enough, that you can study that one lesson and get into a lot of detail and do a lot of different things.

In EDC's video cases for administrators, the analogy to the "lesson" is one instance of principal supervision that involves observation of a teacher's lesson.

Making a credible case

To be credible, the video cases must reflect what the teachers deem to be real, not staged. The classrooms, teachers, and students must reflect a variety of teaching contexts and non-contrived teaching conditions.

> I think the videos need to be linked to the participating teacher's context. [In our project] we stress more having a large library of lessons than having just a few really good ones, because you want to have lessons that represent all kinds of curricula and textbooks and standards and all kinds of different students… We need a large variety of alternative examples of clear images of implementation.

> You want the classroom to look like theirs and you also want to have teachers on the video making a few mistakes in the classroom. I really think teachers benefit greatly from seeing that other teachers can adapt and recover from mistakes. Teachers have problems with a "model" classroom video that is too perfect. They look at it and they say, 'yeah, well if I had those kids and I had a Ph.D. in math and so on and so forth, I could teach like that, but what does this have to do with me?'

Addressing this design principle involves making trade-offs between the benefit of achieving credibility and the expense of "shooting on location" in just the right classrooms. Addressing it also involves selecting instances of practice that, while not unrealistically perfect, portray teaching that can both enlighten and inspire teachers.

Design challenge 3: A scaffold for using video cases

There is more to the design problem than producing the right images of practice. Video designers also typically build scaffolds that support teachers' productive interactions with the video cases. The common (though not universal) assumption among designers is that video alone is insufficient. Some designers emphasize the need to create a curriculum that helps teachers analyze video cases:

> It is not just enough to say to a group of teachers, now here is a video, watch it and analyze it. They don't know how to do that. We don't even know how to do that. We need to figure out the most effective way of watching a video and analyzing it. We need to find out how to teach teachers how to do that, and we need to build a curriculum for doing that.

Some designers assume it is best to use video cases as one of several types of resources that contribute to teacher learning:

> I see video as being one of a number of resources that you can get together to bring out a central idea…reading published articles that highlight particular ideas, reading written cases of teachers in the process of change, looking at student work, doing mathematics related to the same pieces that you are seeing in video… video is a powerful access point, but just by virtue of using it, it doesn't necessarily mean that those core ideas have come full circle.

When producers of video cases design scaffolds for teachers' learning from video cases, they make decisions related to the following spectra of design parameters:

- Video alone *vs.* video plus. Is the material in video medium intended to serve as the only mode of delivery and focal point for the professional development activity, *or* is video one of several modes of delivery and focal points that work together with video (e.g., discussion, study of student work, involvement in discipline activity, demonstration, etc.)?

- Direct *vs.* mediated interaction with video. Is the video material designed for direct use by teachers, *or* is it intended to be presented to teachers by a "third-party" professional development leader?

- Course to follow *vs.* adaptation or self-direction. Is the video material designed to be followed as a course of study, i.e., in a specific sequence and as a whole, *or* is it designed as a set of resources for self-directed learning or adaptation to an existing course of study?

The projects that were demonstrated at the conference reflect a variety of decisions along these dimensions. The Science Media Group, for example, has created elaborate video workshops and courses that teachers can follow with minimal facilitation and that, if taken in their entirety, entitle teachers to university credit. The Video Cases for Mathematics Professional Development has created video cases that require intensive facilitation by professional development leaders; the video cases are part of workshop modules that include other activities such as problem-solving and reading of articles. The TIMSS-R Video + LessonLab group has created web-based, interactive analytic tools that enable teachers (and others) to examine a wide range of video cases.

A RANGE OF DESIGN CHOICES

Video cases for professional development can be designed as a flexible resource to be infused into a variety of contexts and used for many purposes. Or they can be designed as coherent courses that can only be used effectively as a whole. Video cases might be designed for direct use by teachers with little or no skilled facilitation. Or the material might require heavy facilitation by a sophisticated leader. The projects demonstrated at the conference exemplify a range of design choices. Developing and testing a variety of resources is important to support change and to advance knowledge in the field.

A = Science Media Group/A-CPB workshop series
B = LessonLab software
C = Video Cases for Math PD
D = Teachscape
E = Images of Administrators' Ideas in Practice/Lenses on Learning

Intensive and
sophisticated facilitation

C

Multi-purpose   B   Whole, coherent
tool, resource   E   curriculum, course

A

D

Little or no facilitation
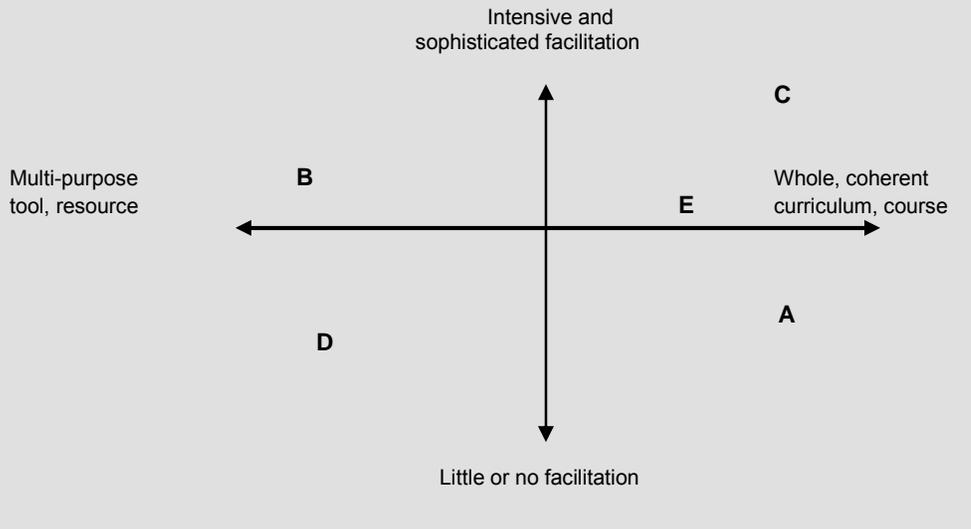
IV. USE IN CONTEXT: THE DANCE BETWEEN DESIGNER AND USER

The design of video cases is only half the equation. How do design decisions affect use in the field? How do users act on the resources that are designed?

The designer's perspective: Fidelity and coherence *vs.* flexibility and discretion

Not surprisingly, designers have strong visions of "appropriate use" for their video material. The uses they envision vary according to the learning purpose they have in mind and the nature of the resource they are producing. The spectrum of appropriate use runs from high fidelity and minimal user discretion, at one end, to maximum flexibility and user discretion on the other.

The VCMPD project expresses a high demand for fidelity. User discretion threatens to reduce the coherence and completeness of the learning opportunity, which in turn can undermine the research function of the material:

> The module links a series of video cases together into a coherent professional development program, and is intended to be used in the order in which we put it out there.

When users ask to use the program differently – for example, to fit it into a shorter time frame – the designers must (re)define the limits of faithful use with respect to the learning goal:

> Each video case is designed to be used in a 3-hour workshop, but we are already beginning to have to work around that. We are trying to figure out, what do you scale back when you only have 2 hours?… We have a pilot site that says 'can you help us scale [the 8-session module] back to 5 sessions?' So I tried, and I have a warning label that I put on it – 'this is what you are going to give up.' It is pretty hard. If they tell me they have only 4 sessions, I am going to tell them I can't do it, I can't help you scale it back that far – I don't know what you would get.

The VCMPD project presents the additional challenge of relying on sophisticated facilitation. Few district professional development coordinators have the specialized knowledge needed to present the material with real fidelity:

> One of our biggest worries is that we have created materials that only we can facilitate. It is no good if we are the only two people that can run around the country doing these. So we need to learn what it takes to enable others to use these video cases and to use them in a way they

were intended – in ways that are likely to impact teacher learning and practice.

At the other end of the spectrum is the LessonLab software. This analytic tool is sophisticated but when mastered, it allows users (teachers or professional development leaders) maximum flexibility in interacting with the video cases and supplementary material. LessonLab's flexibility of use is consistent with the project's learning purpose, which differs from that of the VCMPD project. A downside to the modular, flexible approach adopted by Lesson Lab is that there is no guarantee of coherency in their use. Conference participants noted that the dilemma of flexibility *vs.* fidelity is inherent to the design of all curricular materials, whether for students or teachers.

The user's perspective: Realities of system and context

Users of professional development resources – reform project leaders, district professional development providers, teachers – scan the educational horizon for resources that are of high quality and suit their needs. If they are sophisticated, they see themselves as partners in reform, helping to bring theories to life in schools and classrooms. Even the most sophisticated consumers, however, work in local political, cultural, and financial conditions that influence their choices. Those in schools feel "accountable" to raise achievement on standardized tests, and to do so quickly. This pressure can diminish schools' (and teachers') capacity and propensity for the kinds of in-depth teacher learning and change that the standards-based reforms require. Even more fundamentally, there is an absence in the education system of an infrastructure for improvement, i.e., an absence of "built-in" space, time, support and resources for teacher development.[10]

Thus, while potential users may well have the desire to use long and carefully sequenced courses with fidelity, they typically have little real capacity to do so:

> It is very hard to set up these time slots to do this consistently and to do it with coherence. In our district you are fighting a lot of other professional developers who want time with teachers. You have science, you have math, you have language arts, history, and that doesn't even include Character Counts, your drug program, your band program, your arts program, PE. It is overwhelming. And so setting up the use of video cases in some type of fashion that the teachers want is a real challenge. These are huge factors that really affect what you can do.

In these conditions, professional development leaders tend to treat a video program not as a coherent whole, but as a malleable resource they can take apart and reassemble for use within their own frameworks.

They extract smaller grain sized segments that address explicit concerns of their audiences:

> First of all, I look at it [an 8 hour video series] and think about how I will adapt it. I have to be my own editor in terms of what I select. I would pretty much have each one of my PD sessions arranged. We have to look at the spacing and timing of our events, and have something that really actively engages them in activities, and you have to have something that provides opportunity for reflection. So I choose elements based on those kinds of basic PD principles. Then maybe I can only use 10 minutes of this clip instead of 20, because that is how I am going to have to shave it down.

The sophisticated user thus does not ignore the producer's careful design; rather, she draws from it to make adaptations that are as theoretically sound as possible, given her need to contextualize the material. It is important to the user to know the designer's intention, even if she cannot follow it with fidelity. Herein lies the dance between the designer and the user:

> You start trimming without trying to disintegrate what is there. It is helpful to have those templates [scaffolding materials prepared for facilitators] as a guide – maybe there is something pointed out in the template that you hadn't thought of that you would like to include. I think having the template there is always helpful – but I think you have to have your audience in mind, and what has gone before the video, and what is going to follow it.

General patterns of curriculum use

There are three general approaches to using curriculum for professional development, and they apply to the use of video material. The most common use is through what we call "infusion." This refers to the insertion of a very small grain size segment into an existing program:

> The primary use of video cases in our K-8 science project has been to show brief segments (5-20 minutes) of classroom lessons as illustrations of best practice. These clips have been used in site-based learning forum groups of 4-8 teachers to help set the vision for science instruction and as a catalyst for group discussions of classroom management, collaborative planning, student discussions, concept development, assessment and evaluation. They are also used in sessions at our Summer Institutes and in sessions with site administrators who need to see examples of science instruction to learn more about what it can look like.

These segments might have been designed as small grain sized resources, or they can be bits that users have extracted from larger wholes as we describe above. A second approach is to use a curriculum resource as a "replacement unit." In a week-long institute on the teaching of mathematics, for example, a professional development leader might

replace an existing half-day workshop on assessment with a new video case workshop on assessment.

A third approach, "full use," involves offering a series or course as a whole:

> We have used several Annenberg series as the basis for courses or study groups. [Private Universe, Looking at Learning… Again, Learning Science Through Inquiry.] …Our Video Communications Department downloads Annenberg programs and publishes a schedule of times when programs can be viewed. A group of teachers may elect to view a series for increment credit as a study group.

Full use is the least common pattern. However, programs such as the Science Media Group workshops (though users often deconstruct and infuse them) can feasibly be offered as whole courses because they require very little facilitation and they can be viewed on a flexible schedule in tape format.

The relationship between design and usage at scale in the field

Design decisions result in trade-offs associated with the scale of usage in the field. Video resources that are both *more flexible* and require *less sophistication* tend to be implementable on a *broader scale* in *a wider range of contexts*. They thus have potential to help push a larger segment of the field to take an incremental step toward a reform-based vision of teaching and learning.

Video resources that require *more fidelity* and *more sophistication* tend to be usable in a *narrower range of contexts*. Thus, they may have smaller scale, albeit deeper, immediate influence.

Both kinds of resources are necessary to the field. Developers of sophisticated tools that demand more fidelity in use can feel pressure, often from funders, to reach beyond a scale of usage that is optimal. But investment in research and development of such materials is critically important because they are testing the validity and efficacy of ground-breaking ideas. They have a research function that can help push the field beyond current norms and practice.

DESIGN PURPOSES AND CHOICES AFFECT DEGREE OF IMPLEMENTATION

Innovations that are in the early stages of R&D serve primarily a research purpose. They are tested in selected conditions rather than being implemented widely, and are intended to produce knowledge rather than to effect change. Some (not all) innovations become scalable, that is, amenable to large-scale production and widespread implementation. Design choices can also affect the degree of implementation. Resources and tools that depart radically from the norm or require great sophistication and fidelity in use will be used in a narrow range of contexts. Tools that require less sophistication, are more flexible, and are incrementally different from the norm have the potential to be implemented more widely. R&D efforts at both ends of the implementation spectrum make important contributions to knowledge and improvement of practice.

Departure from the norm
Sophistication
Fidelity

Scale and extent of implementation
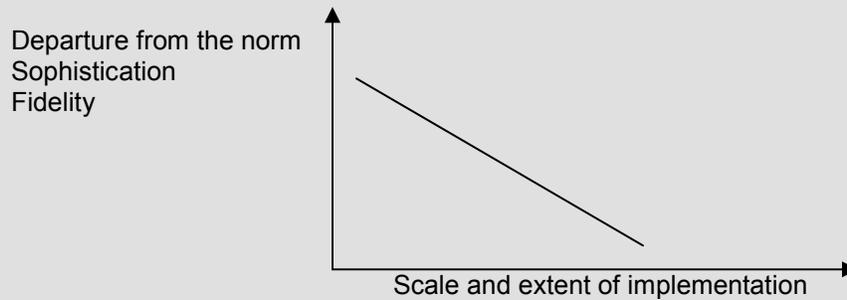
V. LOOKING FORWARD

Designers and users alike share the desire to open windows onto classrooms through video so that more teachers can have access to informative and inspiring visions of teaching. There is reason to be optimistic about the potential of video cases to support teacher learning, and reason, too, to be cautious because video as a technology and medium for professional development is not yet well understood or used, and will never be a panacea.

Sustaining investment in educational innovation

The American education reform habit of punctuated, short-term investments in improvement projects – with the accompanying pressures to develop simple solutions that scale up quickly – is of concern to all. From the designers' perspective, the absence of sustainable reform contexts, or a reform infrastructure, in the schools undermines high quality use of resources:

> One of the reasons that I think fidelity rarely happens is that we rarely see sustained reform efforts. Maybe we should be thinking less about the fidelity right now and more about sustainability – how do you develop contexts where professional development activity can be sustained over time?

Similarly, practitioners in the field cannot rely on transitory reform projects:

> Reform resources are very unstable in terms of their accessibility. We cannot put too much of an investment into anything, because we don't know how long it is going to be around.

Developing video cases as a new type of professional development resource that can be used well requires long-term, steady effort and investment. Those who are committed to pursuing this development must resist succumbing to pressure to focus too early on implementation and scale, and instead try to pursue deliberate design experiments with the aim of building resources that are both theoretically robust and useful to the field. And funders who invest in the development of these new resources must be willing to support a deliberate, engineering-like approach so that resources made to be usable at a large scale are sound.

The examples of these projects suggest that it is to NSF's advantage – and thus to the field's – to invest long term in a diverse portfolio of video projects for research, development, and implementation purposes.

Directions for ongoing research and development

Both design research and basic research projects can help advance the field.

Design research

Projects involved in design research have the primary, and even sole, purpose of generating knowledge about the effective design of videos and their use. For this purpose:

♦ Producers of video cases should continue to define and explicate the key design dimensions, challenges, and tradeoffs inherent in the construction of video-based professional development curriculum and tools.

♦ Producers, together with users, should undertake deliberate experimentation with different ways to use video cases and to scaffold teachers' interaction with them. Such studies should recognize the power of context as an actor in innovation. Key questions:
- What are effective pedagogies of professional development related to video?
- What case-based materials are needed to make a video case into a teaching case?
- How are video cases best integrated with other kinds of professional development experiences, such as mathematical problem-solving, scientific inquiry, examination of student work, and so on?
- In what ways do different contextual factors (grade level, region, student characteristics, teacher characteristics) affect teachers' interaction with video cases?

Basic research

Basic research uses video cases as a way to study more fundamental issues of teacher learning and of the kinds of knowledge that support effective teaching practice. For this purpose:

♦ Developers of video-based resources want to examine the role of video cases in teacher learning:
- *How* do teachers learn when they view video records of classroom practice?

- *What* do teachers learn? That is, how does analysis of video cases add value to teachers' content knowledge? to their vision and goals for teaching and learning in their classrooms? to their attitude toward students? to their professional identity and community?

♦ An important corollary question is: how do teachers learn from examining videos of their *own* practice? Video technology may be able to support the tradition of reflective practice and teacher action research.

♦ How do the two modes of analysis of classroom practice – of others' practice and of one's own – relate to one another, and contribute to teacher learning and improvement?

A research forum

Gatherings of people whose work is leading the field can bolster research and development in any domain of innovation. Those who participated in this conference feel that it was useful in advancing their own work and in contributing to the larger R&D effort. We thus conclude with a plea from the participants. As designers, users, and researchers of teachers' professional development using video cases, they need a forum to continue exchanging ideas, challenges, and lessons learned. Such a forum can help them continue to build their collective practical wisdom, as well as to generate knowledge of value more broadly. NSF and other funders could make a significant contribution to knowledge and practice related to teacher development by sponsoring ongoing R&D conferences involving designers and users of video case materials.

[1] Elliot Eisner, *The Educational Imagination*. MacMillan: New York (1979)

[2] Those reforms linked, for example, to the National Research Council's National Science Education Standards and to the National Council of Mathematics Standards for Mathematics, as well as to high-profile research on teaching and learning, including reports arising from the Third International Mathematics and Science Study (TIMSS).

[3] *What Matters Most: Teaching for America's Future*. National Commission on Teaching and America's Future (1996)

[4] Supported by grant ESI-0092547 from the National Science Foundation.

[5] We include a list of participants at the end of the document.

[6] Unless specifically attributed to others, all quotations embedded in or set off from the narrative are from conference participants. Some have been edited slightly for clarity.

[7] In the chapter "Ethnographic microanalysis of interaction" in *The Handbook of Qualitative Research on Education*, edited by LeCompte, et al., Harcourt Brace: New York (1992)

[8] For more theoretical background about the kinds of knowledge teachers can and must learn, refer to the research of Deborah Ball and her collaborators, some of which is included in the References and Additional Resources. Ball was unable to attend the conference but her work has informed much of what was presented.

[9] See the National Research Council's *The Power of Video Technology in International Comparative Research in Education*: National Academy Press, Washington DC (2001)

[10] For an in-depth discussion of improvement infrastructure, see Mark St. John's essay "The Improvement Infrastructure: The Missing Link, or Why We Are Always Worried about Sustainability," a panel presentation for the on-line conference Sustainability2000, sponsored by TERC. Available at http://sustainability2000.terc.edu/invoke.cfm/page/123.