Digital Technology in Classrooms: Video in Teaching and Learning

Ronald THORPE

> Across the world children have entered a passionate and enduring love affair with the computer. What they do with computers is as varied as their activities. The greatest amount of time is devoted to playing games . . . [but they also] use computers to write, to draw, to communicate, to obtain information. Some use computers as a means to establish social ties, while others use them to isolate themselves.
>
> Seymour Papert

It is not surprising that the introductory quote comes from Seymour Papert. What Thomas Edison was to the beginning of the electronic age and Joan Ganz Cooney to children's programming on public television, Papert has been to the computer age and the use of computers in learning. What is surprising is that it was written in 1993 in the preface for his book, *The Children's Machine: Rethinking School in the Age of the Computer.*

Think about 1993. Although it was less than a generation ago, the "superhighway" of the Internet and World Wide Web was still in its infancy. There was no Google or Yahoo! No eBay. Online shopping was next to nothing—Jeff Bezos didn't found Amazon.com until 1994. Most personal computer screens shone with an eerie green font, and graphics were nowhere to be found. Forget YouTube and FaceBook and Second Life and a dozen other social networking sites that are now staples in the lives of hundreds of thousands of people, mostly young but not entirely.

And who were Papert's "children"? Most of them were born in the 1980s and some in the late 1970s. Their first game was probably "Pong" and many of them knew what punch cards were. Yet Papert already sees a "love affair"

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with the machines among children "across the world." If it was a love affair in 1993, today our vocabulary has nothing to describe the heights of passion and dependency people have for computers and technology.

This article looks at one of the ways digital technologies can be used and are being used in the classroom. As a video-based and video-driven company, Thirteen/WNET, one of the flagship public television stations in the United States, is especially interested in the role that video can play in teaching and learning. Video may not be the answer to all learning challenges, but we at Thirteen/WNET believe there are areas where video is uniquely positioned to make a difference, both in terms of the learners themselves and what is to be learned. One particular resource that is now being used by teachers and students is VITAL (Video in Teaching and Learning), a collection of video clips and instructional activities aligned to math and English language arts to be explained in detail below.[1]

Background on Video in Teaching and Learning

Film

We begin with an old idea: the use of video in teaching and learning. Film and video—and even for a brief period television itself—have been part of America's classrooms since the middle of the twentieth century. Anyone old enough to have been a student in the United States in 1950s and 1960s remembers the 16mm film projector, the hum of the little fan that cooled the motor, the characteristic sound of the take-up reel engaging, and the flap-flap-flap when the film came to an end. In the middle, there were many chances for distraction, chaos, and hilarity: when the sound and image lost their synchrony, when things speeded up or slowed down, and when an image slowly burned if the teacher dared to pause the film in order to make a specific point. Of course, there is also the classic memory of the lights coming back on and the teacher's groan when she discovered the celluloid was hopelessly entangled in a pile on the floor. Students found ample openings for mischief in the

[1] This resource can be found at http://vital.thirteen.org/, and I invite readers of this article to explore it for themselves as a "guest" of Thirteen/WNET. A simple registration is required, and readers should identify themselves (in Step 2A) as being connected to an "independent non-profit" (Thirteen/WNET) in order to explore the materials. The process takes only a few minutes to complete.

Readers are also invited to explore additional video-based resources created by Thirteen/WNET and distributed at no charge through the station's Web site. The direct link to these resources is http://www.thirteen.org/edonline/, and no registration is required. There is a "Bulletin" to which people can subscribe that provides monthly updates on additions to this page. There is no charge for the bulletin or any materials available through the EdOnline website.

safety of those darkened classrooms, even as the teachers themselves found the chance for a brief rest from instruction or the chance to catch up on paperwork at the back of the room. Most of the time, the use of film in teaching and learning was a lesson in dreams deferred.

As miraculous as film was and is—giving teachers and students the chance to view moving images of life and nature as they really occurred or as they were created for the medium—it was cumbersome. In addition, people knew too little about the cognitive advantages of the medium, trusting that the images themselves magically would result in increased learning. Despite some valiant efforts on the part of teachers, the use of film always seemed to stand apart from what was being taught and learned rather than integrated seamlessly into the classroom environment. Still, even under such primitive and ill-conceived pedagogical applications, there are few American students from that era who will ever forget the undulating Tacoma Narrows Bridge—a classic in physics classes illustrating wave theory—as several cars were tossed over the side when a seemingly solid bridge was transformed into a fluid ribbon responding to the unseen force of the wind. Given the ubiquity of video cameras today, seemingly recording everything that happens everywhere, no current student could possibly appreciate the "miracle" that someone with a movie camera just happened to be near that bridge at the moment it started to move, but for physics teachers everywhere it was as if Hollywood had just presented them with the perfect example of science happening in everyday life!

Equally memorable during that era was the new American film series, "You Are There," taken from a television series. It was narrated by a young news-anchor-in-the-making, Walter Cronkite, who intoned, "What kind of a day was it? A day like any other day, except *you are there,*" as CBS transported its audience to important days in history through dramatizations. Such is the power video has on the viewer.

Television

Television itself burst onto the American school scene with great promise in the late 1950s. Here was an inexpensive way to bring new learning to large numbers of children. I have vivid memories of being herded into the gymnasium of my elementary school along with the other third grade class in 1961 to watch on a very small television screen something called "new math." The impracticality of a broadcast schedule, however, combined with only a rudimentary understanding of how to use the medium in teaching and learning, soon pushed the television out of day-to-day instruction. Its life did get extended through some current event coverage. Our entire elementary school

often sat on the floor together to watch (on that same small screen) the important moments in the early U.S. space program, beginning with Alan Shepard. In retrospect I realize my student colleagues in other time zones—especially in the far western part of the U.S.—probably never got to witness these events because they were largely geared to mornings which meant anyone not on eastern standard time was probably still asleep.

By the mid-1960s, television itself was developing a bad reputation, ultimately leading Newton Minnow of the Federal Communications Commission to refer to it famously as "a vast wasteland." That lofty phrase was transformed in common lingo to "the boob tube" or "the idiot box," which pretty much put into deep freeze any hope educators might have had to use television as a resource in classrooms.

Public Television

Minnow's alert eventually led to the establishment in 1967 of the Public Broadcasting Service. Although woefully underfunded by the U.S. Congress, which preferred to fund it through appropriations rather than a tax on television sets (as was the case with the BBC in the United Kingdom), the infusion of cash from corporate and foundation underwriting, along with the federal money, suddenly breathed new life into the kind of shows Americans saw on "educational television." Rather than starting with a school-based audience, however, the early pioneers in public broadcasting wisely focused on adults and pre-school children.

Things got off to a strong start when *Sesame Street* premiered on November 10, 1969. Created by Children's Television Workshop, the brainchild of Joan Ganz Cooney and Ralph Rogers, *Sesame Street* proved almost from its very first program that television could play a positive role in teaching pre-school children their numbers, their letters, and important lessons in socialization. Nearly 40 years later, the series—often referred to as "the longest street in America," if not the world, because of its longevity and its penetration around the globe—remains the gold standard for children's programming.

In terms of convincing the broad public about the power of television to speak to humanity's highest standards (rather than Minnow's "vast wasteland")—especially through the delivery of quality information and entertainment—one cannot overlook the importance of the success public television had with older audiences. *Masterpiece Theater* became a staple in many American households on Sunday nights, tackling such heady literary topics as *I, Claudius,* created from Robert Graves' classic novel, and a litany of others

supplied largely by the BBC. In 1972, the performing arts were brought to television audiences in ways that arguably surpass the experience of being there in person through *Great Performances*, and in numbers that dwarf what the largest halls could ever hold. Two years later, Americans were introduced to *Nova,* a series that dealt with serious scientific topics. It won a prestigious Peabody Award in its first year on the air, and remains the model for how television can capture and explain the mysteries of science and make it accessible to the general public. In fact, all of these series are now well into their fourth decade and are true icons in the history of television.

Americans also began turning to public broadcasting for news and information. Two young reporters, Robert MacNeil and James Lehrer, came to the nation's attention via PBS during the Watergate hearings of 1973 that led ultimately to the resignation of the country's president, Richard M. Nixon. By 1975, MacNeil and Lehrer became a regular fixture in American households through their nightly news program that has aired continuously under a variety of names ever since.

But something else happened on American public television in the mid-1970s that is often overlooked in terms of harnessing the power of television as a teaching tool: the "how-to" programs. Public broadcasting pretty much invented this genre with programs like *This Old House*, *Crockett's Victory Garden*, and *The French Chef*. Although I am speaking from an "n" of only one, in my mid- to late 20s, I had the courage to buy and renovate an old farmhouse based entirely on what I learned from *This Old House*, was keeping a large vegetable garden thanks to James Underwood Crockett, and was inviting friends over to dinner because of the confidence Julia Child gave me. I am sure that I was not alone in using television to help me learn how to successfully negotiate at least part of my life as an independent adult.

What broadcast television failed to do for me (or anyone) in explaining "the new math" in third grade, it was now doing effectively, around things that were far more complicated. The industry had crossed an important threshold, led in large part by public broadcasting. Moreover, adults in large numbers were experiencing for themselves meaningful and memorable learning as a result of television, giving the medium credibility as an aid to education, even though it was not being promoted in that way to formal educators and schools.

On Demand

By the 1980s, the availability of VHS tapes eliminated some of the hassles of film in classrooms and broke down the previously insurmountable obstacle of a broadcast schedule. Most teachers were comfortable putting a cassette into

the machine and having the program play through a television set (even though few knew how to get the VCR to stop flashing the ever-present 12:00). Convenience aside, the pedagogical gaps persisted. There was still a heavy reliance on showing whole programs in darkened rooms, and once again the technology started to get a bad reputation when even informed observers perceived teachers were using the tapes as a replacement for teaching rather than an enhancement to learning. Furthermore, some of the most trusted programs, especially those with content that was more appropriate for high school students, simply did not work well within the time restrictions of a traditional class period.

The move from analog to digital production and transmission of video, however, has brought new opportunities to the learning process. With this technology, teachers can use small pieces of video to help illustrate points and convey meaning—rather than tell complete stories—and these clips can be available to students and teachers literally whenever they need them via computers and various handheld devices. The technological barriers to integrating these materials into teaching and learning—combining them with traditional modes of lecture and text and more constructivist environments in which students are actively involved in the learning process—have mostly disappeared, but the pedagogical barriers persist. What remains is the need for the fullest possible understanding of when video adds unique value to learning and how teachers and students can harness that value.

As the technology has evolved from film to television and now to portable and on-demand resources, the digital revolution has opened what could be the final door to using video resources to enhance teaching and learning. Most of the remainder of this article is devoted to an example of how Thirteen/WNET is taking rich video content, culled from its award-winning broadcasts, aligning it with specific pedagogical needs, and getting it into the hands of teachers and students.

Video in Teaching and Learning (VITAL)

In 2005, Thirteen/WNET received a grant from the United States Department of Education under its Ready to Teach program to create VITAL. The grant allowed Thirteen and its partners to embark on a three-year study designed to generate new knowledge about how video can be embedded into instructional strategies. The work is tied directly to teaching and learning as defined by the New York State learning standards and measured by the high-stakes tests administered in math and English language arts for students in grades 3–8, but it is easy to imagine expanding this model to other contexts.

Education in the United States is ultimately the responsibility of the individual states, not the federal government. Consequently, each state has its own standards and requirements for graduation from high school. The federal government does play an important role, primarily under the No Child Left Behind (NCLB) Act authorized in 2001 (see below for more on this subject). This legislation requires teachers to know more about the needs of individual students in core subject areas (first in math and English language arts, and eventually in science and social studies), have the tools to respond to those specific needs, and utilize those tools so that all students achieve to high levels. Those levels, however, are based on standards determined by each of the fifty states. The goal of VITAL is to create and distribute video resources that are designed to increase student performance in math and English language arts in New York State. These resources will exist on their own, be accessible through at least two different websites (Thirteen's own Ed Online site and New York State's Virtual Learning System), and eventually within an electronically delivered analytical tool that shows teachers precise information about student performance levels measured against New York State standards. VITAL resources, including related professional development opportunities, initially are being distributed to teachers in New York State for math and English language arts. These materials will be expanded to include social studies and science, which the state also tests in grades 3–8.

VITAL is being developed, distributed, and tested by four principal partners: Thirteen/WNET, the Education Development Center's Center for Children and Technology (CCT), the Grow Network/McGraw-Hill Company ("Grow"), and Hezel Associates ("Hezel"). The strength of this collaboration is compelling because of what each partner brings to the task, because of the connections that exist among the partners, and because of work that is already well underway.

The Grow Network's Online Analytical Tool

While all of the partners are critical to the work being developed through VITAL, the original impetus for VITAL was connected to a product created by The Grow Network, a company of educators and designers dedicated to a comprehensive approach to using assessment to improve instruction, now owned by McGraw Hill. Grow is committed to helping teachers reach toward the standards, and motivated by its concern about the harm that can be done by reporting data in a way that encourages "teaching to the test."

Grow believes two requirements are necessary for a reporting system to foster instruction that is both informed by test data and grounded in the stan-

dards: 1) the categories of reporting, and the instructional materials they generate, must *deeply explain the standards that occasion the test;* and 2) the reported data and the recommendations made must work in complete concert to encourage the thoughtful use of data. The analytical tool—originally called the Grow Report but rebranded for use in New York State as "nySTART" (New York Statewide Testing and Accountability Reporting Tool) is supposed to give teachers a concise, balanced overview of class-wide priorities based on student performance on the state's high-stake tests in math and English language arts (grades 3–8). It also groups students in accordance with their learning needs, and enables teachers to focus on the strengths and weaknesses of individual students. Each report is grounded in "categories of comprehension" that encourage teachers to act on the information they receive and to promote standards-based learning in their classrooms. These categories not only help to explain the standards, but also are derived from cognitive and learning sciences research about effective math and literacy learning. Grow did extensive work with its analytical tool in New York City schools—in partnership with EDC's Center for Children and Technology—and the success of that work led to a contract with the New York State Department of Education to create a similar product, electronically delivered, for use statewide. This product was rolled out for New York State in the fall of 2006.

Thirteen: The Use of Video in Teaching and Learning

As a public television station, Thirteen has been producing the highest quality television since the early 1960s, before there even was a Public Broadcasting Service. Since 1989, its Education Department has been delivering professional development designed to help teachers make effective use of video in teaching and learning through the National Teacher Training Institute. Substantial research confirms the value of video in helping learners develop deeper understanding, especially when it is combined with other modes of instruction such as text, lecture, and hands-on activities. Recent technological developments are making it easier to integrate video resources into classroom practice, moving beyond entire programs and focusing instead on selected clips.

Thirteen also has been the driving force behind the introduction of an educational video-on-demand service (EdVideo Online or EVO) that is available free to all teachers and students in New York State. Use of that service, originally developed by United Learning and later bought by Discovery, has exceeded all expectations with more than 7 million video clips viewed in the first four years (September 2002-August 2006). That service has a searchable

database of more than 4,000 full-length programs divided into more than 40,000 clips, and more resources are being added each year.[2]

Based on the rapid rate of adoption by teachers—in all types of schools throughout New York State—and mountains of anecdotal testimony from teachers, it is clear that teachers see great potential in the use of video in teaching and learning.

Even a cursory look at EVO, however, reveals that although it is certainly a step in the right direction, it has many of the same weaknesses that are found in most teaching and learning resources. EVO is based on a library model—i.e., a vast collection of materials that a person must search in hopes of finding just the right thing. It also is based on a "one-size-fits-all" format that emphasizes the delivery of generic content to a whole class rather than tailoring that content to the specific needs of individual students.

What if a teacher didn't want to wade through a library of video clips to find what she needed? What if clips were pre-selected and tested for their effectiveness in moving students toward higher levels of performance in the specific content strands identified within the State standards? What if these clips and the related instructional guides were available to teachers online, embedded in reports showing teachers how individual students are performing according to those strands? And what if teachers received professional development in how to use these resources effectively? VITAL is grounded in the promise implied in those questions.

In the 2005–2006 school year, Thirteen, working with CCT, began to identify and test video clips that appeared to have value in increasing student performance in math and English language arts (grades 3–4). These materials came primarily from Thirteen's animated math series *Cyberchase* and a variety of other programs. Instructional activities were created around the clips for use with students who are performing below proficiency, and other activities were created for use with students who are performing above proficiency so that those students also could be moving ahead in their achievement. CCT tested the efficacy of the clips and the activities with teachers in the targeted grades and content areas. Through this process of formative assessment, clips were added or discarded and activities were refined. Eventually the clips and activities were embedded in nySTART and also placed in a stand-alone VITAL website.

[2] Discovery sells the license to this library of clips and related materials, password protected for registered subscribers, to schools throughout the United States and probably to schools in other countries, as well. Many public television stations have purchased this license on a statewide basis, but Discovery also licenses the service to other entities—school districts and individual schools, for example—which in turn can make it available to their constituents.

Before going further, the following examples should provide a more specific explanation of how and when the VITAL resources might be used by a teacher.

Example 1

Within the New York State Math Standard, there are five content strands: number sense, algebra, geometry, measurement, and statistics and probability. A fourth grade teacher will have access online to a report indicating how her students did on each of these content strands, providing the percentages of students performing below and above the proficiency level. Teachers also will have access to the results for individual students, providing an even more fine-grained view of what teachers have to do to help students improve their performance.

In looking at the "Statistics and Probability" strand, the teacher notices that 57 percent of her students are performing below proficiency. In order to help students improve their performance, the teacher must focus on the five "bands" of content included within this particular strand: collection of data, organization and display of data, analysis of data, predictions from data, and probability. While these bands define the content she must introduce to her students, her most important instructional decisions are those that will address the needs of individual students to help them move from whatever their performance level is toward proficiency and beyond. Under these conditions the data becomes a critical tool in decision making, and with it a teacher has a better chance of differentiating her instruction so that it results in gains by individual students.

While she is digesting the information available to her on nySTART, the teacher sees that next to each strand there is a link to VITAL resources. Focusing on "Statistics and Probability," she clicks on that link where she finds a video clip from Thirteen's animated math series *Cyberchase*. Beneath a thumbnail image from the clip, there is a brief description of the clip and its purpose (in this case to illustrate ways that two or more sets of objects can be combined), an indication of its length (in this case 91 seconds) and the choices of whether to stream the clip (which she can do for previewing purposes) or to download the clip (which she can then put directly onto her hard drive or burn onto a disc). There is also a description of the Math Standard, the content strand, and the band to which the video clip is aligned. Finally there are the Instructional Priorities (for levels below and above proficiency) with an instructional focus to be used with the video depending on the student's particular performance level. For example, a student scoring below proficiency might be asked to identify the two types of objects that are used in the clip by

the characters as they decide how to display and analyze their data, or to identify the number of possible combinations using one of the objects and have them list each combination. A suggested focus for a student scoring above proficiency might be to identify the total number of possible combinations and to list each combination, or to add two additional objects and identify the total number of resulting combinations.

In this particular example, there is a single video clip with different focuses for students depending on their performance level. In other situations there might be completely different clips aligned to the different levels. But in every case, teachers will use data that describes where a student is in performance in order to make decisions about instructional strategies designed to move that student's performance to a higher level. The video clips and strategies are preselected for her, and she has easy access to the resources making differentiated instruction more likely.

Example 2

One of the great surprises during the development of VITAL has come with English language arts. Whereas we knew we would have strong content in math thanks to the existence of the animated math series *Cyberchase*, we were uncertain about where we would find strong content for English language arts. In working with CCT and the teachers who have participated in the formative assessment, we discovered that we in fact did have strong content for this area in the archives of our award-winning series *Nature*.

While the producers of *Nature* have always considered their primary audience to be adults, the way the programs are created also makes them valuable to elementary school teachers. First of all, most of the programs involve animals, sometimes animals that are a part of a child's everyday life, but more often they focus on animals that are innately interesting to child because of their exotic nature, their size, their rarity, and their unusual characteristics. *Nature* covers animals like whales, snow leopards, gorillas, giraffes, and pandas, which immediately elicit strong interest from children.

Second, there is very little voice-over in *Nature*. The images speak for themselves. Since the VITAL resources always include a complete transcript of the clip, teachers are finding the transcripts themselves an important part of the lesson plan. Furthermore, teachers have told us that they have a special challenge finding good non-fiction literature for children to wrestle with, and these transcripts provide them with a resource they need as students learn to extract information from text.

And third, many elementary school teachers—who in most schools are

content generalists—have an additional challenge covering science and geography along with everything else they have to teach. Clips and transcripts from *Nature* often give them the chance to provide instruction in science and geography at the same time they are working with students on required skills in English language arts.

What follows is the transcript from a two minute and thirty-nine second clip from a Nature episode called "Panda Baby."

Wolong's Pandas

Innovative research with captive animals has one all important goal—understanding the needs of their counterparts in the wild. For endangered pandas, that's a world seven thousand miles away, high in the misty bamboo mountains of China.

Pandas are such dedicated bamboo eaters, they've even evolved a pseudothumb to grasp the stalks.

But the bamboo forest is shrinking and sometimes larges patches flower all at once, seed, and then die. Then there isn't enough for the pandas to eat.

In the 1970's, disaster struck when a mass die-off of bamboo occurred. Many pandas died.

But when another bamboo die-off began in the 1980s, the Chinese were ready. They brought the starving pandas down from the mountains and into captivity.

Many came here, to the Wolong Conservation Center for Giant Pandas.

This is one of China's two major panda research centers.

At first, Wolong keepers nursed the pandas back to health in the hopes of returning them to the wild. They added milk and bread to their diet because even here, keepers can't gather enough bamboo to sustain the pandas. Each one can eat around fifty pounds of bamboo a day.

So, the Chinese made a kind of "bamboo helper"—by mixing ground-up bamboo with rice, corn, vitamins and minerals.

The resulting flour is baked into a nutritious bread.

The pandas revived and the Chinese hoped to start a breeding program. But years went by without a single birth. What's more, poaching had become a serious problem.

This crippled animal lost its paw in a poacher's snare. Wolong's pandas weren't going back into the wild.

One fifth grade teacher reported that she printed out this transcript for her students and asked them to read it before watching the clip. She asked the students to circle any words that were new to them. Not surprisingly, most of her students identified "pseudo-thumb" in the second paragraph as a word whose meaning was unclear to them. After showing the clip—which has a close-up of a baby panda holding a piece of bamboo—she then asked her students to make some guesses about the meaning of "pseudo-thumb" from the context of the video. From there, she led them in additional discussions about other words they might know that begin with a silent letter "p." These are all well-tested word decoding and vocabulary learning skills that were triggered by the video.

This teacher also used the clip for geography (asking students to locate China on a globe), for math (making guesses of how big the Earth is if China is 7,000 miles from New York), for science (discussing issues related to species and species preservation), and civics/politics (discussing poaching and what it requires to protect endangered species). This collection of uses represents so much of what learning is all about since it represents how things are connected within a context and how the most successful learners are able to identify the clues within the context that lead to understanding and the ability to derive meaning. Of course, because all of these lessons are set within compelling video and the story arc of narration, learners of all types have a better chance of retaining the information.

While this example speaks to specific content areas associated with high stakes testing in math and English language arts in grades 3–8, Thirteen is also building similar video-based resources for other areas of the K–12 curriculum. One new resource, Window into Global History, is designed for high school students throughout New York State who are enrolled in a course called Global History and Geography, a requirement all students must meet in order to receive their diploma. Approximately 200,000 students are enrolled in this two-year course every year. A series of downloadable video clips from

Thirteen's series *Wide Angle*—which covers contemporary world issues—have been selected and arranged according to the themes covered in Global History and Geography. Extensive lesson plans are also available.[3]

Context and Research Base

In January 2002, President George W. Bush signed the No Child Left Behind Act into law, fundamentally changing the way schools in the United States would view the education of children. Assessment, accountability and standards have become the cornerstone of our new educational culture, with a special focus placed on students in greatest need—students coming from low-income families, students with special needs (special education students), and English language learners.

With this increased commitment to accountability, school systems were required to use standardized assessments to capture academic performance data so that teachers and administrators can develop instructional strategies tailored to each student's learning needs. The success of this work depends on having (1) standardized assessments in all grade levels in core subject areas; and (2) teachers and administrators who are prepared to understand the data and use it to develop instruction that supports academic achievement.

New York State, for example, embraced the spirit and goals of NCLB through the development of statewide standards in all core subject areas and also through the development and administration of tests designed to measure student achievement according to those standards. With each step in the process, however, the New York State Education Department has learned more about the gaps that make it difficult to achieve the goal of having all children moving on the path toward proficiency.

One such gap has been in the system's capacity to ensure that all critical partners—superintendents, principals, teachers, and parents—have access to data about student achievement that goes beyond a raw score on a test. All tests on core subjects measure different areas of achievement. The math standard in New York State, for example, is comprised of five content strands, and the strands are further divided into bands of more specific content. Running across the content strands are process strands. Two students with exactly the same scores on the Grade 3 math test could have vastly different needs in order to help them improve their performance level. All parties need to know what those next-level student needs are and what instructional strategies are available to act effectively on the data.

[3] Readers can explore this resource, which won the 2007 Goldman Sachs Award for Excellence in International Education, along with others, at www.thirteen.org/edonline.

New York State has taken an important step in addressing this need by awarding The Grow Network a contract to create and deliver an analytic tool for teachers, parents, and school administrators across the state for students in grades 3–8 (math and English language arts) and for all students in grades 3–12 who qualify for the state's Alternative Assessment (special education). The Grow Reports (later renamed nySTART) were introduced and tested in New York City over a five-year period, and their efficacy was corroborated through a two-year study conducted by the Center for Children and Technology (Honey et al. 2004).

In CCT's research about data-driven practices in New York City, they learned that teachers often experienced a disconnect between the concepts described by the standards and the state tests for which they are accountable. Without appropriate tools and resources teachers often feel that they serve two masters: the *standardized test* (for which they have to prepare their students) and the *local standards* that determine their curriculum. The two are not always compatible and sometimes in direct conflict. The fact that the Grow resources are directly aligned with the test results helped teachers to build a connection between their students' test results and the concepts and skills on which the standardized tests focus.

When standards call for discovery of complex concepts, for example, and the tests call for the mastery of specific content, teachers can feel caught in the middle. The rich conceptual work takes away time from the focused test preparation that would have a more direct impact on student scores, but without the time for more complex learning processes in which a greater variety of skills and strengths can be exhibited and practiced, students who are least successful continue to fall behind. By adding video content (and related materials) that is aligned to the specific New York State Learning Standards in English Language Arts and Math in grades 3–8, VITAL has the potential of helping teachers combine the "two masters" by linking resources to both standards and test results.

Aligning curriculum, instruction and standards is difficult (Pellegrino, Chudowsky and Glaser 2001). The work proposed through VITAL attempts to take proven instructional methods and combine them in such a way that results in a seamless alignment among these three functions, thereby increasing the likelihood that instruction will lead to increased achievement.

The Need for Data and the Efficacy of Grow Reports in Providing Data

When teachers have access to data describing the strengths and weaknesses of individual students, and when that data is aligned to research-based teaching

strategies, teachers are able to respond to the needs of individual students in ways that result in higher student achievement. The Grow Network spent more than five years developing assessment reports that provide teachers with a clear picture of how their students did on the previous year's state tests in math and English language arts (grades 3–8) within three basic categories: Help with Fundamentals (students scoring in Level 1 and 2), Additional Instruction and Practice (students scoring in Level 3), and Advanced Work (students scoring in Level 4). Based on how students performed on certain test questions, the Grow Report also provided teachers with strategies they can use to help move their students to higher performance. A two-year study of the Grow implementation in New York City found that (Pasnik and Keisch 2004):

- Data-driven decision-making requires that appropriate data be turned into useful information that can aid in the making of knowledgeable and informed decisions (Ackoff 1989; Drucker 1989). Digital technology has played a major part in making it possible for educators to interact with appropriate data that can be used to make decisions on a more informed basis. Specifically, the relative ease of use and sophistication of data gathering, storage, and delivery systems has made data accessible in a meaningful format to whole sets of constituents whose access to data in the past was either nonexistent or presented in dense and unintelligible reports (Wayman, Stringfield, and Yakimowski 2004).
- As a tool, the Grow Report tries to underscore the ways that test data can be used to inform instruction, not just accountability. It provides a format that builds a bridge between standards, testing results, and instructional strategies, and gives educators guidance on constructing a rationale for differentiating instruction.
- Teachers use the testing data provided in the Grow Reports to plan activities, lessons, and units. They sometimes use it as a starting point for conversations with students, parents, specialists, and administrators. Teachers mostly use test data to allocate their own resources: time, attention, practice, and homework.
- As a resource that aligns test results with standards and instructional strategies, the Grow Report is highly successful in creating a navigational framework for educators. Grow Reports present data in a format from which teachers can draw the information they need to support differentiating instruction and thinking about students' weaknesses as well as their strengths. In this sense, the Grow Reports help teachers navigate the tensions that exist in a high-stakes climate between the accountability model of schooling, where data from standardized tests drives assessment and

defines the standards, and a reform model, where diversity is considered in the curriculum and is defined by differentiated pedagogical practices tailored to the needs of individual students.

Need for Improved Math Instruction

The need to improve mathematics instruction is well documented. The National Assessment of Educational Progress (NAEP) indicates that the United States is making steady progress in fourth and eighth-grade mathematics (the percentage of fourth graders at or above "Proficient" doubled between 1990 and 2000), but as of 2003, only 32 percent of fourth-graders and 29 percent of eighth-graders were performing at a "Proficient" level—the level deemed appropriate by The National Assessment Governing Board standards (National Center for Education Statistics, NAEP, 1990–2000 and 2003 Mathematics Assessments).

Although progress in mathematics achievement is occurring among all ethnic groups, it is not equal. 2003 NAEP data shows that while 43 percent of white fourth graders are performing at or above "Proficient," only 10 percent of black fourth graders, 16 percent of Hispanic fourth graders, and 17 percent of American-Indian students are performing at or above that level. Even more striking are the percentages of fourth grade students achieving "Below Basic": white 13 percent; black 46 percent; Hispanic 38 percent, and American Indian 36 percent.

Differences between achievement levels of eighth-grade students along ethnic lines are equally striking. In 2003, 37 percent of white eighth graders were at or above "Proficient," but the percentage for black eighth graders was a mere 7 percent; for Hispanics the number climbs slightly to 12 percent, and for American Indians, 15 percent. The percentage of white students who achieved "Below Basic" was 13 percent. For black eighth graders, the percentage was 61 percent; for Hispanics, 52 percent, and for American Indians, 48 percent (National Center for Education Statistics, NAEP, 2003 Mathematics Assessments).

Results from the 2003 Trends in International Mathematics and Science Study (TIMSS) show that mathematics performance among United States eighth grade students is lower than that of 14 other countries (Mullis, et al. 2004).

Need for Improved English Language Arts Instruction

The need to improve achievement in English language arts is equally well documented. The latest results from NAEP show that between 1998 and 2003, on the Reading and Writing Report Cards, the percentage of fourth-grade stu-

dents at "Proficient" in reading increased by only 2 percent (from 29 percent to 31 percent). Also, only 28 percent of fourth-grade students achieved the level "Proficient" on the 2002 Writing Report Card.

In a five-year period documented by NAEP, eighth-grade students made no progress in reading: from 1998 to 2003, only 32 percent of students were at or above "Proficient" level.

As with mathematics, there is a marked disparity between white and ethnically diverse students. As early as fourth grade, the percentage of white students at or above "Proficient" in reading is noticeably higher than that of black, Hispanic, or American Indian fourth graders. In 2003, 41 percent of white fourth graders were "Proficient," while only 13 percent of black, 15 percent of Hispanic, and 16 percent of American Indian fourth graders were at or above "Proficient" (National Center for Education Statistics, NAEP, 2003 Reading Assessments). Percentages of students "Below Basic" show a similar pattern.

The disparities increase for older children. In 2003, 41 percent of white eighth graders achieved at or above "Proficient" in reading, while only 13 percent of black, 15 percent of Hispanic, and 17 percent of Native American eighth graders achieved at or above "Proficient" (National Center for Education Statistics, NAEP, 2003 Reading Assessments)**.** For these ethnic groups, far more eighth-graders are "Below Basic" in reading and writing than are "Proficient."

At the middle school level, researchers have begun to identify the effectiveness of English language arts instruction that is an integral component of a comprehensive curriculum (Alvermann 1988; Pearson 1996). Most middle schools in the United States, however, offer little or no systematic reading program, and those that do tend to offer it in the form of separate, corrective, or remedial classes rather than programs integrated into the curriculum (Irvin 1990). Remedial reading classes are typically focused upon basic skills and have been criticized for not addressing the need to teach higher-level comprehension skills (Greenleaf, Schoenbach, Cziko, and Mueller 2001).

More than eight million students in grades 4–12 struggle with reading (U.S. Department of Education, 2003), and according to the *Reading Next* report commissioned by the Carnegie Corporation of New York, as many as 70 percent of adolescent students "struggle in some manner and require differentiated instruction in areas where multiple circumstances conspire against students' chances for success, such as urban centers" (p. 8). In some urban centers as many as 80 percent students are reading below their grade level. (Biancarosa and Snow 2004).

The needs of students in grades 4 through 8 who continue to struggle with

reading and mathematics must be addressed so that they can meet the academic expectations of high school. Meeting the needs of this population will be a challenge as it will require changing how teachers approach their instruction across content areas, and will also demand attention to issues such as student engagement and motivation.

Video Materials Make a Difference

Recent research on the power of video as an instructional resource suggests that when appropriately matched with specific instructional goals, video materials help more students achieve at higher levels and tend to engage many more students in ways that are more compelling than print-only resources. The Corporation for Public Broadcasting (CPB) released a report entitled "Television Goes to School: The Impact of Video on Student Learning in Formal Education" (2004). According to research studies, television stimulates class discussion, reinforces lectures and reading, provides a common base of knowledge among students, and helps teachers teach more effectively. Additionally, video has been found to be effective with special student groups including economically disadvantaged and the learning disabled (Grunwald 2002). With a demanding workload, limited resources, and high-stakes accountability testing, teachers value video when it is connected to curriculum (Fisch 2004).

The CPB study found that instructional video for math was the most requested subject even though "less than half of math teachers reported using video" (p. 11). A separate study conducted by Aiex (1988) also revealed the wide use of video as a tool for motivating writing and that "language arts teachers have successfully used film, news stories, even soap operas to organize writing activities for students at a variety of levels" (The Corporation for Public Broadcasting, p. 13).

Although teachers have been slow to integrate computer-based tools into their classrooms, they appear to be comfortable using video resources, especially when the video is delivered over the Internet, is available in segments (rather than in whole programs), and when those segments are attached to lesson guides and other materials correlated to grade and content-specific state learning standards. These facts are supported by Thirteen's experience with teachers throughout New York State who have had access to a library of video resources available to them through a free video-on-demand (EVO) service. This service gives students and teachers access to Internet-based video and associated materials, and is one of the fastest growing uses of technology in schools. EVO usage by students and teachers in New York State doubled in each of its first three years, and surpassed 7 million views (cumulative) during

the 2005–2006 school year (New York State Association of Public Broadcasting Stations 2006).

Research not only indicates that teachers are comfortable using video, but shows that video content improves student and teacher performance, and changes student-teacher interaction in ways that facilitate student achievement. A randomized study conducted on the United Streaming's Video-On-Demand service by an independent research firm found that student learning was substantially improved by exposure to content-related video clips (Boster et al. 2002). The study, involving over 1,000 elementary and middle school students in three Virginia school districts, showed an average increase in academic achievement of 12.6 percent in students who had been exposed to video content compared to students who received traditional instruction alone.

Additional research studies of specific content that will be used in VITAL for elementary level math content speak to the value of *Cyberchase*, the PBS award-winning children's show produced by Thirteen. MediaKidz Research and Consulting assessed the impact of Season 2 programs on mathematical problem-solving skills among a diverse group of 10 third- and fourth-grade students. Half watched 20 episodes of *Cyberchase*, once a day, while the control group did not have access to the video. Pre- and post-testing involved mathematical problem-solving tasks. Viewers outperformed non-viewers significantly on *all* measures of direct learning, *many* measures of near transfer, and *some* far-transfer measures tested weeks after viewing (Fisch 2004).

National Teacher Training Institute (NTTI)

Thirteen's NTTI professional development model, which emphasizes collaborative, hands-on, technology-based learning through a "teachers teaching teachers" approach, has proven successful across grade levels and subject areas in communities across the country. Evaluations of the NTTI program have recognized its teaching and student achievements. In CPB's 2004 report *Television Goes to School*, NTTI is cited as one of the finest professional services in the field.

A 2004 evaluation of the project conducted by the Michael Cohen Group, LLC, reported that NTTI makes a "measurable impact both on teachers' and students' use of technology in the classroom" (Thirteen/WNET 2004, p. 2). Teachers at the five selected national affiliate sites reported significant increases in their comfort using technology in the classroom, a greater sense of confidence using technology in their daily teaching, and an increased use of technology in the presentation of daily lessons.

Students of teachers participating in NTTI activities were similarly well-impacted. Students reported increased use of technological tools in the class-

room, and an increased sense of competence using the Internet and video resources in their class-work, a result that was strong enough to also improve their overall sense of self-confidence (Thirteen/WNET 2004, p. 2).

Similarly, NTTI's internal evaluation—a three-step survey assessment designed by Columbia University's Teachers College—testifies to the strength and effectiveness of the program. According to the 2004–2005 project evaluations, completed by nearly 5,000 K–12 educators, 95 percent of NTTI participants reported that the project was an effective model for training teachers to use video in the classroom. Ninety-two percent of participants reported that they planned to use the knowledge and information gained at NTTI in their classrooms, and 94 percent rated their NTTI experience as effective in preparing them to integrate media into meaningful, standards-based lessons (Thirteen/WNET, 2005).

In order for teachers to utilize video to enhance student learning and achievement, they must be exposed to strategies and best practices in professional development sessions. *Television Goes to School* cites a 1988 study by James S. Eckenrod and Saul Rockman (*Connections between Television and Social Studies Curriculum)* that indicates that teachers exposed to instructional video resources tended to utilize videos and activities that were demonstrated as examples in training sessions, and far less likely to use materials that had not been demonstrated in training sessions.

Other Examples of Video-Rich Resources for Classrooms

VITAL and the Discovery service are among a wide variety of resources being created. "Video" seems to be *the* place to be these days with not only new online resources being created but also new ways to incorporate these resources in the learning process. At a rather rapid pace, more U.S. classrooms are being equipped with electronic "white boards," for example. Teachers preload their video clips into the memory of the white boards and play them, literally, with a touch of a finger. Hand-held portable devices are also being tested in a number of places so that students can carry around their video wherever they go.

At www.thirteen.org/edonline/, anyone can find video-rich materials associated with many different academic subjects and designed for different grade levels. Teachers and students seeking information on current world affairs can explore www.thirteen.org/edonline/wideangle, a page that is built from clips taken from Thirteen/WNET's series *Wide Angle*. Others hoping to understand more about Islamic holidays and traditions can turn to www.thirteen.org/edonline/accessislam/ where materials have been culled from *Religion and Ethics Newsweekly*.

PBS itself has been aggregating education materials at its new site, PBS Teachers (www.pbs.org/teachers). This searchable site is growing all the time, and ultimately PBS hopes to make it a portal into all public broadcasting materials, whether they are created and housed at an individual station or part of the PBS national programming service. Teachers' Domain, an online resource created by another flagship public broadcasting station, WGBH, contains a comprehensive, searchable library with a mixture of video and animation for grades K–12 (see www.teachersdomain.org/). This collection is especially strong in science but also contains other materials associated with WGBH broadcasts.

PBS also has a large collection of websites associated with all of its programs that have appeared in its national service. Children's programs, such as *Cyberchase*, have many activities associated with the learning embedded in each program—this particular site (see pbskids.org/cyberchase/) has had nearly 2 billion views with visitors spending an average of more than 60 minutes playing math games. Every site has related educational opportunities designed for classrooms, and increasingly these sites also include streaming or downloadable video.

In addition to its free resources, PBS has been building a collection of online professional development courses under the brand TeacherLine. These courses are available in a number of different subject areas. Developed with major grants from the U.S. Department of Education, TeacherLine has gone through an intensive evaluation process.

Another excellent source for high quality resources for use in classrooms is the George Lucas Educational Foundation and its publication (in paper and online) *Edutopia.* Educators can find hundreds of different videos representing diverse and best practices in individual academic subjects and whole school reform going back as far as 1997 (www.edutopia.org).

I do not intend this list to be comprehensive. It represents only a small portion of what is available to teachers and students over the Internet. The challenge to all educators, of course, is finding trusted materials that work well in learning environments.

Conclusion

The work outlined in this article shows how educators are gaining a greater understanding of how video—especially in clip form and delivered digitally—can enhance the learning environments of classrooms. VITAL is an example of how video and related instructional activities can be embedded in instruction and connected to very specific achievement expectations as measured by standardized test results, with instruction differentiated for individual stu-

dents. Bridging the gap between assessment and instruction is at the very heart of data-driven decision-making in schools. The nySTART reports position the data of test results as road maps to future instruction not just for the lowest performing students but for all students. VITAL introduces the power of video into this teaching and learning tool kit and delivers it in ways that make it easy for teachers to integrate these resources into their existing curriculum, and to tailor the instruction to the specific needs of individual students.

Based on the early and robust adoption of EdVideo Online among New York State teachers, research done specifically on that service, and the broader literature that supports the value of visual resources in advancing student learning, the partners hope to take video usage to the next natural step. Teachers have limited time for preparation and even less for instruction. Even though EdVideo Online, with its searchable database of segments, is a vast improvement over earlier technologies, it still requires each teacher to wander through a massive library of potential material and then figure out how to integrate these materials with other classroom resources and match them to individual students. VITAL resources intend to cut right to that final point, providing teachers with resources already proven to be effective in improving student performance. By placing these segments and the related materials within the resources presented in nySTART reports—which themselves are already aligned with the demonstrated needs students have in order to move to the next step of mastery—Thirteen and its partners believe that the potential of video resources can be more fully realized, and that teachers will have a chance to use valuable data to make decisions about instruction for individual students based on their individual strengths and weaknesses.

While the promise that rich video resources could enhance learning environments has been with us for more than half a century, it has moved much closer to reality through the digital revolution. Seymour Papert's preface from 1993 describes clearly the deep affinity children have for the kind of learning and entertainment that is possible through computers and presages the migration of these powerful technologies beyond desktop devices to cell phones, pda's and MP3 players. Challenges remain in terms of how to use technology in classrooms, but through examples such as VITAL, we seem to be making significant breakthroughs in demonstrating how bringing these tools into classrooms can make a difference in how students learn.

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