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Projects and Padlocks—A longitudinal look at professional development in using technological tools at a Native American school

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Description
Effective professional development experiences can help teachers integrate advanced technological tools over the long term into their classroom practice. These efforts are challenged by educational policies that redefine student learning as a knowledge production task, while many advanced technological tools develop student understanding in ways not currently assessed by these productivity measures. This study describes the case of a Native American teacher working with elementary aged students five years after attending a successful summer workshop on using advanced visualization tools. It describes the ways in which he negotiates the collision between the demands of the productivity curriculum and a more human educational agenda. This case illustrates the way in which teachers engage in constructing their own program of professional development.

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Educational technology, teacher professional development, advanced technological tools

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Abstract:

> the teacher [is placed] in a state of tension between two poles: School tries to make the teacher into a technician, in most cases a sense of self resists, though in many the teacher will have internalized School's concept of teaching. Each teacher is therefore somewhere along the continuum between technician and what I dare call a true teacher. (Papert, 1993, p. 55-56)

The fundamentally human character of teaching is being increasingly invaded by technical thinking that reduces education to a production task (Charles 2004a, Charles 2004b, Charles 2007). Neal Postman called this invasion technopoly (1993): the monopoly of technical thinking in all human endeavors. The reauthorization of the Elementary and Secondary Education Act (ESEA), frequently referred to as No Child Left Behind (NCLB), provides a vivid example of this phenomenon in the policy arena. In NCLB a standards-based curriculum furnishes the "production specifications;" standardized assessment tools function as quality control checkpoints; and mandated performance levels determine whether schools are making "adequate yearly progress" in an effort to identify "failing schools." Recent "Race to the Top" initiatives (2012) include measuring teacher quality based on performance on selected measures. Education has been redefined as a production task.

As the quote at the beginning of this article indicates, Seymour Papert (1993) recognized technopoly in the schools, but suggested *technology* can paradoxically "shuck off the technical nature of School learning" (p. 56). For Papert the problem is not the

presence of computers in the schools; the problem is the technical way of thinking determining their use. He believes computers could be used in very different ways to help rethink schooling. Parker Palmer (1998) has written about nurturing the human side of teaching in the face of this technopoly. In one example he describes the particular reforms in education a medical school pursued and how these led to preparing more caring professionals.

Over the long term, how do teachers who use technology negotiate the tension between technopoly and a more human education? This question has become more pressing as NCLB has an increasing impact on teachers. This article describes the case of one teacher in a unique setting five years after an effective workshop on the use of advanced scientific visualization tools to enable mathematics and science inquiry. This case addresses the question of how successful teachers are in using technology in their classrooms amidst changing circumstances years after the workshop in an educational climate increasingly influenced by productivity thinking.

Methods

The case described here was taken from a longitudinal study of Project Visualization in Science and Mathematics (VISM), an National Science Foundation (NSF) sponsored summer workshop project for 118 middle and high school mathematics and science teachers from around the country in 2000-2002 focused on learning four different advanced scientific visualization tools to use in the classroom. The four tools were: ImageJ (the Java-based successor to NIH Image), ArcView GIS (Geographical Information Systems software), STELLA (a systems modeling program), and RASMOL/Chemscape Chime (a public domain molecular visualization program). Post

workshop assessment data indicated participants viewed the initial workshop as well-organized, effective, and a very valuable learning experience.

Survey data collected from more than half of the active teachers in the project two to five years after the workshop indicated that more than half of them had adapted activities from the workshop and/or created their own projects using at least one of the tools. Based on survey responses, a sample of interest was created in which the investigator conducted a one-day visit to the participant's classroom to learn more about how these tools were integrated into every day teaching practice. The one-day visit format was first piloted with a few teachers, and a set of three open ended questions for the interview was constructed. Those questions were:

- Briefly describe one or two projects you carried out last year with your students using one of these visualization tools.
- What things helped you use the tools with your students, and what were your greatest obstacles in using these tools with your students during the year?
- Briefly describe what you think you accomplished this year based on your participation in the VISM workshop, and one thing you had hoped to accomplish but perhaps did not.

Interviews were carried out with thirty percent of the active teachers in the project four to five years after they completed the workshop. The interviews were recorded and transcribed, then coded for themes informed by responses to the earlier survey questions. Member checks were performed, including sending a copy of the case study write-up to the teacher to check for accuracy. Two of these cases were recently summarized as part of a book chapter about implementing GIS in secondary classrooms

(Kolvoord, Charles, & Purcell, 2014). The results from these surveys and follow-up interviews have clear limitations. They rely on teacher self-report data, there was no use of a random sample group design, and there is no direct student learning data.

The case described here was unusual. All the other teachers in the project were middle or high school teachers who were able to utilize the tools taught in the workshop. In this case the teacher had moved from a Fifth grade classroom to a teaching assignment in a K-3 school located on a Native American reservation. The VISM tools were not appropriate for that grade level, and at the time of the visit he was not using any of them. But he did engage his students in technology projects and found value in his experience with Project VISM in a way that sheds an interesting light on the process of teacher professional development.

The Case of John: Unlocking Learning in a Native American School

A two-lane highway traverses the Colorado plateau in long, straight stretches, skirting past the spectacular cliffs on the reservation and a trading post on the left side of the road. A couple of miles along this dirt road is the paved driveway of a new and stunningly beautiful K-3 school. At the time of this visit ten teachers and instructional personnel served about sixty students. Walking into the school, one is struck by the beauty of the setting in this high semi-arid landscape. John works here as a computer resource teacher in a computer lab. He meets with all the students in the school at least once a week. His students work on a variety of projects. In his role as a computer resource teacher he also uses technology as a curriculum management tool in collaboration with the teachers in the building.

John has participated in a couple of different NSF projects. In the summer of 1992 was a participant in a month-long workshop in which he learned about and helped develop activities for NIH Image, a powerful and user-friendly public domain image processing program used by scientists at the university as they worked with planetary images (Greenberg, 1998). John and this investigator were the only two elementary teachers at that workshop, and we often found each other to discuss using the tool with our students as those around us considered filming super balls in physics and capturing gel electrophoresis in biology. There were other teachers in that project who taught on reservations, but John was the sole Native American. Following that workshop we would see each other occasionally at the annual conference held for a couple of years following the conclusion of the project. Ten years later in the summer of 2002 John came to James Madison University in the Shenandoah Valley in Virginia to participate in Project VISM. He completed a follow-up survey and was selected for an on-site visit and interview in part because of his unique setting: an elementary teacher at a Native American school who had not been able to implement any of the VISM tools in his classroom practice.

Technology Projects

On the day of the visit, John was doing some interesting projects with his K-3 students using multimedia storytelling and desktop publishing tools. There was a multimedia PowerPoint presentation his approximately 20 third grade students assembled by working with their homeroom teacher with John's support. They created this in preparation for a visit to a Bureau of Indian Affairs (BIA) "contract" or charter school hundreds of miles away in California. The third grade students first corresponded with

students of another tribe at the school, and then went to meet them in a special charter bus trip.

This remarkable presentation has 20 slides, including recordings of native songs from local dances. In watching it, one is reminded John speaks very little Navajo, because he went to school in another time when Navajo culture was seen as something to be discarded. Children were taken from their families on the reservation and put in Indian boarding schools "intended to assimilate Native people into mainstream society and eradicate Native cultures" (Davis, 2001, p. 20). Davis suggests these schools "served as sites of both cultural loss and cultural persistence," (p. 20). This multimedia presentation prepared by the third grade students is an embodiment of a very different education being provided today.

On the day of the visit the third grade students were finishing their essays about the trip. These one-page essays described what they did and what they learned. They included a photograph of each student in front of the school in California. His plan was to take each of these essays, save them as webpages, and post them on the web to share with parents and other interested readers. Here is a typical essay, entitled, "Our Trip to San Diego, California,"

> We rode on the Warrior Bus to San Diego. Some of the parents came with us. Some teachers came with us, too.
>
> On Wednesday, March 15, we went to the [other school]. I met a new friend named Emily. I enjoyed playing with my new friend. We played tag. I saw some birds in a cage and saw some roses and a water fountain at the school. I learned

> many things about their school and what they do most of the time are the same as the things we do at our school.
>
> Early Thursday morning, we ate breakfast and packed up our stuff. We placed them in bus and took off back [home]. I really liked the trip. I wish we could go again.

This essay is a good example of having students develop their language arts skills as they write about an important experience. John developed this assignment in consultation with the third grade teacher. The school provided an experience rich in many ways, especially in sharing their culture with another group of students from another tribe in another state. Publishing student work is an important function of technology for this teacher. He believes that:

> It starts with the needs of the students…for publishing the students, it wasn't just publishing. It started out with a need students had to empower themselves. If they had a reason to write, if they had a purpose for doing it, then they are much more empowered to write because the web is a very powerful display tool. And if they can see their writing on the web, published for the world, that makes the power of writing even that much more important. So the need was there for empowering the students and providing them with a purpose to write. The next stage was how do we get that? It is one thing to write for the teacher and have it posted in your classroom. It is a huge empowerment to see it posted for the whole wide world.

John publishes student work in many ways. These third grade essays would be displayed on the school's server on filespace that he manages. He taught himself how to edit websites using several different tools, most recently DreamWeaver

Curriculum Management Tools

Projects are not the only things that happen in this lab. He also helps support the use of the district's adopted "curriculum based management" (CBM) software for tracking student progress in reading and mathematics. This software is a "scientifically-based, formative assessment system that 'informs' the teaching and learning process by providing continuous student performance data and reporting improvement to parents, teachers, and administrators to enable evidence-based evaluation and data-driven instruction." (AIMSWEB 2007). John's school was focused on making adequate yearly progress (AYP) as defined by NCLB, and this software was an important part of trying to improve their mathematics and reading scores. As a teacher in the school, helping all students master these skills is paramount, especially with a group of students who historically struggle to do so. John first gave his rationale for using the VISM tools on a survey, saying, "I believe these are valuable tools for learning. However, my school has prioritized the curriculum to cover reading and arithmetic. Therefore I target those two areas when students come to the computer lab." The CBM software helps identify the instructional needs of his students on a school-wide basis.

So it would seem John is right at the center of the conflict about NCLB, the tension between technical ways of teaching (represented here by the CBM software in use in his lab and the need to improve student productivity measures such as reading and mathematics scores) and more cultural approaches (represented here by the student publishing projects he does in the lab and their connection to student experience and Navajo culture). On the day of the visit students were observed using the lab both for test taking and for Mother's Day card making. One might call this tension the "curriculum

collision," where the productivity curriculum collides with a more broadly cultural or human educational agenda.

But John sees value in the district's software tools as well as the project tools in use in his classroom. He did not experience a curriculum collision, but instead he negotiates both of these forces to create better learning opportunities for his students. He described the value he saw in using the CBM software with his students:

> Two things. One is to share with the students how they are doing. I think that is the biggest value that I see. The students are owning their own progress. They are aware of where they are at. That is more important than just having data to provide for your district. And that's what we do in here. I sit down with the kids and say, "Look, this is what you did and this is where you are at. Now would you like to know how the other kids did?" And the kids (say), "Yeah." "Would you like to know where you are at compared with other kids? "Yeah." And they get an idea. They say wow. Well what do you want to do about it. Well I am going to get myself up there next time. I am going to try a little harder. How are you going to try? What are you going to do to try? Instead of just generalizing and saying, "well, I am going to check out a book and I am going to read on my own." Things like that, that you want them be the one to initiate on their own…To motivate [the students]—that's the most important part right there.
>
> The other part, which is the [CBM] thing, that is more of a tool for teachers to place their students and then to start. I think that is good for a monitoring [role] of the teacher.

In the higher stakes assessment environment created by NCLB, John believes the CBM tool helped his students monitor their learning, motivates them to learn more, to try harder, and to read more independently. For John, all good technology-based projects start with the students; and all good uses of the CBM data begins with showing the students how they are doing so they can do better. Students in many Native American schools are not making AYP toward meeting reading and mathematics goals (Office of Indian Education, 2007). For John, the CBM tool helps promote better student achievement, a goal he strongly supports. He uses the language of empowerment and ownership both for the projects he does, and for the test scores he analyzes with students. These two elements are not colliding for John, but instead are collaborating for better student learning.

Professional Development

John taught himself how to use Dreamweaver, web-publishing software, after the VISM workshop. John says VISM gave him the knowledge of the possibilities that computers offered his students. As new tools have come along, he was confident of his ability to learn and apply those tools with his students in part because of his experience learning more advanced tools in VISM. Dreamweaver, though not a scientific visualization tool *per se*, has a similar layout to some of the tools taught in VISM: a toolbar with icons that do various tasks, the use of pull-down menus, and the importance of knowing the path to the files with which one is working.

When asked how VISM had contributed to his professional development in a more general way, John said:

> I think it raises the comfort level on my part to investigate further. And it also provides for me an awareness that there are things that are doable with students in the classroom. I am not, how might you say, limited to just what is available. [I can] go beyond things because you know there are things that you can do even though the things that I have learned in VISM [are] really not applicable to the grade levels that I work with. I know there are things towards that end that I can provide for my students.
>
> And again, the things that were taught, the by-products of VISM. The creativity. The…uh…always remember that phrase—[the] aha moments—I try and create that among my students. Where they discover that they had just accomplished something and *they* had done so. And now the next task is to go back and figure out how they get to what that aha moment produced. So I think that is very valuable in my area working with younger children. That they need that approach that says, Hey, I can do it. If I have an idea, I am going to strive and see if they can get it done. I think it has provided me with that outlook toward learning. Using the computer as a learning tool.

So for John, even though he is not using any of the tools learned in the workshop, the professional development was still apparent. It provided him with an outlook on learning that saw the computer as something that could first empower his own learning, and then eventually empower his students' learning. It instilled in him the confidence he could figure out how to do more advanced things with technology. And when he figured new things out, when he had those "aha" moments, he felt more confident in his own ability to learn. It was that kind of experience he wanted to impart to his students, no

matter what their age, and no matter what the tool. It is that kind of experience he had at these workshops.

Technology and Human Values

Picture John standing, not in the lab, but inside a secure room next door that houses the server that he uses for publishing student work on his school's website. A visit to the district website reveals that there is a lot of discussion of the organization's mission and building a culture of excellence. Quarterly plans, state standards, and staff information are all visible links on the left hand menu on the school site. But the link to student work is broken, as are the links that John provided to see the finished 3rd grade essays online. For John it is important to publish student work online for a larger audience. But that does not seem to be supported by his school or district. The server John was using to publish student work has been made increasingly less accessible for him by district procedures. Originally John could create files and upload them to the server from his teacher computer. Then one day access was cut off, so he went in to the room where the server was housed. It occupies part of a room that is also used to store custodial supplies.

The server is encased in a metal cabinet, with a padlock hanging there. It was unlatched at my visit, though one wondered how long it would stay open. John's vision for publishing student work is just one click of a padlock from being denied. Seymour Papert, in the quote at the beginning of this article, described a tension between the technical and the human sides of teaching. The padlock dangling on the door to that server reminds one this ongoing struggle is often not an even contest.

John's case has important implications for teachers and teacher education. If practicing teachers regularly negotiate conflicting demands in the workplace between technical and the cultural side of teaching, how do we support them in this process or best prepare them for this effort? John seems to have a clear internal compass for his use of technology in the classroom: it should provide for better student learning, and student empowerment/student ownership is the mark of better student learning. Better student achievement scores are a goal worth working for as a means to this greater end of a better education. How common is this approach? Informally through the work with the teachers in Project VISM this view seems widespread, but many Project VISM teachers are early adopters of technology and thus may not be typical of the teacher population as a whole.

Current wisdom regarding teacher professional development advocates site-based, curriculum-specific professional development efforts with significant on-site follow-up (Rodriguez, 2000; NSDC, 2010). Yet Project VISM was nearly the opposite of those recommendations: a university-based program with materials that had only general curriculum connections and with no significant on-site follow-up component. Does John's experience suggest that there is still room for excellent university-based programs where teachers learn a great deal personally and are still charged with a great deal of responsibility for taking this new learning and applying it to their own practice? The emerging consensus that effective professional development efforts for teacher should resemble more tightly structured training sessions may not give sufficient credit to the intrinsic motivation that drives successful educators to conduct what is in effect their own program of professional development, one that is unique to each professional. John spent three weeks learning four tools that he then was unable to implement in his classroom,

yet he still regards this learning experience as very worthwhile. John's case suggests it is important to attend to the fundamentally constructivist nature of teacher learning.

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