New Forms of Collaborative Repository Development Involving Students, Teachers, and Japanese Lesson Study

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Abstract: This poster reviews a novel form of NSF- and IES- supported professional development research that explores teacher conceptual and pedagogical change as they develop a repository of videos of worked examples that shadow school curricula. Several elements are unique, including the creative role that teachers are expected to assume, the implementation of Japanese Lesson Study as the collaboration methodology for teacher interaction, and the involvement of student teams in creating peers for video.

Introduction

The expression "teacher creativity at the intersection of content, cognition and digital media" (Hamilton, 2010) captures much of the vision of this research this poster presents, research that challenges assumptions both about professional development and about digital repositories of learning objects, where the US National Science Foundation has made sizable investments, most notably in the National STEM Digital Library (NSDL) Program (National Science Foundation, 2010). Work in projects supported by NSF (Hamilton, 2010) and the US Department of Education (Hamilton & Harding, 2008) has been based on the conjecture that enabling teachers to exercise collaborative creativity in the form of teams that producing digital media could yield surprising and powerful results in the quest to accelerate and deepen student learning in high stakes accountability environments. The project thus focuses directly on teacher creativity. It also focuses on the process of drawing peer tutor students into the teaching community by engaging them in the effort to build by a cadre of student tutors working alongside their teachers. Together, in collaboration with Pepperdine University's mathematics department, and drawing deeply on the methodology of Japanese lesson study, Los Angeles mathematics teachers and student tutors are creating a growing digital collection or repository of digital media reflecting the curriculum and standards of the four year high school sequence of standards that students are expected to master in high school.

Surface and Deeper Outcomes

This repository development is also fundamentally participatory and both teacher –centric and student-centric. Combined with the lesson study methodology, it relies on the collaborative, reflective and generative work of teachers for the substance of professional development in ways that elude even current reform practices (e.g., Darling-Hammond & Richardson, 2009). This approach to use lesson study to produce a living repository of creative mathematics lessons has two immediate and significant "surface" outcomes: a) finding practical means for teacher teams to build and exercise creativity through digital media is inherently rewarding and meaningful; it elevates the sense of professionalism and identity of teachers. Additionally, b) the repository becomes a dynamic and powerful resource that students come to use frequently to form robust mathematical knowledge, in contrast to many digital libraries. Beyond these two immediate benefits, it is becoming clear that more subtle and powerful teacher changes "beneath the hood" take place. The level of teacher sophistication both about cognitive pathways in mathematical development and about mathematics itself escalates significantly.

Video Creation

The notion of engaging teacher teams in digital object development originated in work by SRI, International and the TRAILS project that NSF funded in 2002 (DiGiano et al., 2002). TRAILS was designed in part to draw teachers into the mathematics applet development process. This effort contributed to the design of a project entitled "Agent and Library Augmented Shared Knowledge Area (ALASKA)" that includes the TRAILS PI (Chris DiGiano) and that NSF's Computer Science Directorate supported (Hamilton, DiGiano, Cole, & Martin, 2004). Neither TRAILS nor ALASKA focused primarily on teacher development of media, and neither successfully realized the active teacher production of mathematical content in digital media. Researchers found that teachers did not have the time, energy, or technical software skills necessary to help create applets that would be useful in a classroom. The ALASKA project was oriented around integrating digital libraries with software agents and peer tutoring (Hamilton, 2005). The US Department of Education's Institute for Education Sciences (IES) continued support of the ALASKA research, though, through a current Goal II R&D award (Hamilton & Harding, 2008) that re-conceptualized the mathematical object development of the project, based on work at the US Air Force Academy on sustaining learner engagement in mathematics classes (Hamilton & Hurford, 2007). That re-conceptualization shifted from producing mathematical applets from scratch to a) using a combination of tablet computers and screen video software to **create mathematical videos**, and b) using screen video software to make **existing applets or mathematical visualizations available in the National**

Science Foundation digital library repositories more usable in classroom settings. This re-work in the current ALASKA research has now produced two rounds of important interview and survey data that the poster will present. These interviews and surveys confirm the viability of the teacher creativity model. It came about as teacher teams in the pilot work found enormous satisfaction and excitement – not in what university professors or professional development experts imparted in professional development seminars, but in their own generative work. **Teacher teams authored materials that they tailored to the students they teach and to the standards for which they are accountable.**

Teachers Typically Excluded from Considerations of Creativity

We have observed that the prominent role of traditional textbook or reform curriculum producers, curriculum standards and policies, and the very limited time that teachers have outside of the classroom, all act to crowd out their creative potential to produce content tailored to their own student population, local standards, and the teaching styles they have found effective or appropriate for given settings. As in the past, mathematics and science teachers are not expected to be content *producers* but rather are content *conveyors*, following pre-defined curriculum in preparation for accountability tests. But at a time of unparalleled ascendency of user-generated content in society more broadly (as evidenced by phenomena such as YouTube), teachers are strangely left out; mathematics teachers simply are not expected to be creative in producing content. At least, that is the message which comes through loudly when examining state and federal funding programs involving research and innovation in teacher professional development and teacher preparation. Creativity in education more generally, of course, is the subject in a broad range of the literature as well as in specialized research journals. There is robust research on ways to foster creativity **in students** (e.g., Kaufman & Sternberg, 2006). There is a strand of literature in school system administration that explores creativity and flexibility in **leadership** (McCallum, 1999). And, of course, there is an extensive body of literature and research support (especially from NSF) intended to **impart to teachers** creative and innovative instructional activities, materials, and full curricula. NSF review panels for other professional development programs (such as DRK12 or REESE) explicitly reward innovative and creative **researchers**, but ironically appear not to suggest directly that effort should be taken to focus on helping **teachers** understand, exercise, or benefit from their own creativity. With the exception of a very small number of researchers looking at only loosely related issues such as classroom improvisation (e.g., Sawyer, 2004) there appears to be little or no explicit guidance toward helping teachers to function as active and creative agents at the complex intersection of navigating mathematical content and student cognition. (Hamilton & Jago, 2010)

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