

Networked Teacher Professional Development:

The Case of Globaloria

Abstract

The purpose of this paper is to explore a teacher professional development program embedded in a networked learning environment, and to offer an emerging model and analytic matrix of 21st century teacher professional development. The Globaloria program is based on theories of learning by design and facilitates teachers and students as they create educational computer games connected to core curriculum. We situate Globaloria in existing teacher professional development research, and then provide a new analytical framework designed to explore data from an embedded networked professional learning environment. Our analyses point the way for new models of 21st century teacher professional development, and we believe it is helpful for the field of teacher education innovation in general.

Networked Professional Development

The purpose of this paper is to explore teacher professional development embedded in a networked learning environment context, and to offer an emerging model and analytic matrix of networked teacher professional development (TPD). Borko and colleagues (2009) described the use of technology in teacher learning as a “wicked problem,” a term arising from the work of Rittel and Webber (1973) that indicates multiple, complex and dynamic variables in a specific design context—in short, really difficult problems that are not resolved by one size fits all solutions. Additionally, the authors point out the importance of differentiating between how teachers teach using new technologies, and how teachers learn to use new technologies in their teaching. Rudestam and Schoenholtz-Read (2010) argued that the proliferation of networked online learning environments challenge us to rethink “our core beliefs about pedagogy and how students learn” (p.1). We believe that this challenge includes rethinking how teachers learn. How and to what extent do networked online learning environments impact teacher learning?

In order to explore this question, we examined the experiences of teachers in the Globaloria West Virginia (Globaloria-WV) program. The program has completed its second year as a state-wide intervention in a variety of learning contexts, including middle and high schools, a community technical college, and alternative schools. Globaloria uses open source social media and Web 2.0 technology to encourage teachers and students to engage in “learning by design” projects that can be integrated into any curriculum (Caperton, 2009). Specifically, teachers and students use high end gaming software to create educational games for younger learners, often based on themes of social justice or core content such as math or science. The process is supported by an array of social networking media that provide synchronous, asynchronous and face-to-face resources. Learning by design has a rich body of

evidence of its effectiveness in deepening learner engagement, understanding and knowledge across the curriculum (Harel, 1991). While educators were carefully trained and supported (and also received stipends for their participation), TPD research initially was not a central focus of the Globaloria-WV research agenda. However, it emerged as an important dimension for understanding how to develop and scale up teacher learning environments within and across schools. We therefore delineate our process of developing a theory- and research-based teacher professional development model framed by two overarching research questions:

- What types of 21st-century learning programs and related teacher professional development are necessary to respond to the shifting priorities of K12 curricula?
- What insights does the Globaloria TPD provide regarding this?

We situate our research in existing TPD theory and practice frameworks, and then provide a new framework, supported by a purposive sampling of the experiences of five educators who participated in Globaloria-WV. Our analyses reveal some promising findings that we believe will be of value to the field and future research of 21st century TPD models.

Scope of the Problem

Not too long ago, the purpose of public schools was to help students learn reading, writing and arithmetic—it was not typical practice to teach higher order problem-solving or critical thinking in public schools, and the need for online digital literacies did not exist (Wayne, Yoon, Zhu, Cronen, & Garet, 2008). Today, our global workplace and the new Knowledge Economy (Malone, 2004) demand new skills, which require the shifting of priorities within the K12 curricula (Dede, 2000). Today’s students must learn to think critically, problem solve, work across time zones, cultures, and various communication systems. We must develop K12 curricula that extends the development of traditional basic

skills and uses them as “a substrate for mastering complex mental performances” that are valuable in the workplace and for an informed global citizenry (Dede, 2008). However, rethinking curricula is not enough, we must also rethink how teachers and students learn most effectively in the Social Media Technology Age.

Senges, Brown and Rheingold (2008) wrote that as we move away from the “knowledge container delivery method to a more active inquiry method” for learning then we must also think of learning in terms of “*perpetuum addisco*” or “never-ending learning” (pp. 126-7). The authors celebrate this shift as a return to fostering curiosity and creativity among students and teachers. This is a central feature of inquiry-based pedagogical and curricular models that are the heart of the 21st century learning frameworks now adopted by many states in the US to frame curriculum reform efforts¹. Further, Brown and Adler (2008) argued that we must attend to social learning (understanding of content is socially constructed through conversation and group activities about content) as a new model for learning rather than the traditional Cartesian view of transferring knowledge from teacher to student. They argue that just as we have moved to Web 2.0, we must move to Learning 2.0, a demand-pull rather than supply/push teaching and learning model. They wrote that demand-pull learning modes blur the lines between formal and informal education, and engages students in ongoing “flows of action” that are based on real world events that support passion-based learning. Whether one see these calls for reform as a daunting task or breath-taking opportunity, as researchers and designers of TPD we must respond to our changing world and changing focus of education.

Today’s teachers must be up to the task of teaching these skills and concepts. Darling-Hammond and Bransford (2005) argued that teachers must be adaptive experts who continually grow and develop knowledge and skills, rather than work to acquire a core set of skills to be used for an entire career. These ideas of lifelong learning, reflective practice and

¹ See <http://www.21stcenturyskills.org/> for information on the partnership.

passion-based learning are deeply embedded in the theoretical underpinnings of Globaloria-WV, particularly when viewed through the lens of Constructionism and emerging theories of learning and design. Kafia and Resnick wrote (1996), “In constructionist learning, forming new relationships with knowledge is as important as forming new representations of knowledge” (p.2). The use (and misuse) of computers and digital media in public schools has highlighted the importance of these core concepts even further, particularly in light of teacher learning and professional development. In the following sections we describe the Globaloria program and its implementation in West Virginia.

Overview of Globaloria

Globaloria focuses specifically on developing educational programs *for both students and teachers* to engage in social and collaborative game design and construction using open source Web 2.0 platforms, to gain proficiency in the higher order skills and concepts needed for 21st century citizens. Globaloria empowers educators and students in economically and technologically underserved communities to learn and create complex content such as games and simulations and to experience leadership, democracy and globalization through engagement with Web 2.0 and social media technology and game design and production. Globaloria prepares educators and students to:

- Learn within open source communities on a Wiki (read/write, pull/push, surf/post, receive/contribute).
- Design and produce educational, socially-conscious interactive games and simulations.
- Build and raise awareness about issues of importance to their community (local, national and global) through choice and expression of game themes and narrative.
- Engage in positive, virtual communications with diverse communities.

- Practice 21st Century skills such as digital creativity and innovation, virtual collaboration and team work; cross cultural understanding; media technology and computing fluency; and learning of self-determination and reliance.

In the Globaloria program, students in collaboration with their teachers develop projects centering on a social and educational theme, and support the 21st Century Content Standards and Objectives required by the West Virginia Department of Education (<http://wvde.state.wv.us/policies/csos.html>). Students' creation of games that have an educational purpose have been found to enhance the learning of the game knowledge domain considerably, leading to significantly elevated test scores in the given knowledge domain (e.g., the math games students designed in Harel, 1991). However, not as much is known about the effects on teacher learning or extent and durability of teacher change in practice as a result of these gaming experiences, as well as the effects of concurrent participation in online communities of practice, using social networking tools.

Theoretical Constructs and Methodology

The overarching theory that shaped the Globaloria program is derived from Constructionism (itself a blend of earlier theories, such as Piaget's constructivism and Vygotsky's situated learning), which places a value on purposeful learning of a given knowledge domain, using technology as a tool in the learning process. Additionally, we draw from emerging theories of how people learn (Bransford, Brown, & Cocking, 2002), distributed cognition (Salomon, 1993), cognitive apprenticeship (Collins, Brown, & Holum, 1991) and situated learning (Glazer, Hannafin, Polly, & Rich, 2009). Learning by design is not a new idea, and it has been implemented in many schools as project-based or inquiry-based learning, but the development of new technologies has added new dimensions of

possibilities for students and teachers. For example, social networking tools provide new ways of developing and collaborating on projects, and of making teaching and learning visible in ways that were never before possible. The role of these theories in TPD design requires fuller discussion and connection to current TPD research models. In the following sections we discuss these ideas in more depth.

Learning Theories

Constructionism views technologies such as software and networked computing environments as tools to serve a project-based constructive design need (Harel & Papert, 1991). In Constructionism, a learner's given design project drives the technology use, and technology skills are learned in an integrated way, along with the domain of the creative activity. In this way, technology serves as a means, not an end skill to be learned as a goal in itself, and learners' technology projects take on a more meaningful purpose, which we believe leads to deeper, more transferable acquisition of knowledge. It has been demonstrated over decades of research that learners' conscious construction of a computational artifact, as a technologically-mediated public entity, builds knowledge and meaning for the learner and his or her peers (Harel & Papert, 1991; Salen & Zimmerman, 2003). Constructionism addresses the role of social interaction and role-taking that occurs in project-based learning with technology. It incorporates elements of the social cognitive theory of Vygotsky, who emphasized the role of the social environment and social and cultural interaction in knowledge construction and learning.

The Globaloria program is built upon and extends this theoretical foundation with the work of Lave and Wenger (1991) on situated learning and the seminal communities of practice theory developed by Wenger (1998). Social learning theory suggests in part that we learn by observing and imitating others, adopting cognitions and enacting representative behaviors of

others until we more fully appropriate them ourselves. These ideas are closely related to the work of Collins, Brown, and Holum's Cognitive Apprenticeship, an instructional paradigm intended to make thinking visible (Collins, et al., 1991). The researchers argued that the key differences between a traditional apprenticeship and a cognitive apprenticeship are the following:

- Modeling includes making teacher thinking visible to learners
- Learning (when it takes place in a school and not the workplace) is situated in a real world context that allows abstract and simple tasks to arise in contexts and a timeframe that make sense to the learners
- Transfer of skills and concepts are important for school contexts
- Learners must be guided to articulate the connections between common skills and concepts that reach across content domains.

Within Globaloria, expert peers serve as guides for educators, modeling as they teach, and encouraging all educators to teach, model and share with each other using online communication tools and wikis. They collaborate in a 'blurred' learning environment where meetings are described as synchronous or asynchronous, rather than as face-to-face or online. The use of tools like Webex™ or GoToMeeting™ provides the real time audiovisual connection that allows in-depth interactions across distance. It allows a sharing and engagement among collaborators that Perkins calls "playing the whole game," by leading learners to be problem finders as well as problem solvers (Perkins, 2009).

We argue that both process and product are essential to develop skills and knowledge that are transferable across learning contexts. Kafai and Resnick (1996) argued that there is a natural intersection between Constructionism and design—that over time, learning theorists and designers have come to appreciate the important connections between process and product.

This is particularly important for developing a TPD research agenda and developing effective teacher learning contexts. These ideas lead one further to consider the importance of the social construction and community of learner interactions that are key features of process and product in a networked environment. The networked learning environment takes us from blended learning environments to “blurred” learning environments where teaching and learning become visible in novel ways. Blended learning environments are generally clear—one is either online in some learning context, or one is face-to-face. Blurred learning environments occur in networked learning contexts because the learners are often working synchronously across distance and at the same time working face-to-face with a group. The meaning of being “present” blurs as one works across time and distance, and brings new dimensions of learning in networked learning environments.

Teacher Professional Development Theories

The teacher professional development (TPD) model offered by Globaloria includes several features that a preponderance of scholars in the field agree are necessary to provide high quality TPD that may lead to durable teacher change and improved student outcomes (Wayne, et al., 2008).

- TPD is embedded in the school and in the classroom, as well as across classrooms and school systems across the state
- TPD provides ongoing support in the school that allows educators to see and share their own and student work reflectively and collaboratively
- TPD provides support for developing a teacher learning community both online and face to face that creates a safe environment for testing new ideas and new teaching ideas

While these strengths in TPD design are important, there are other factors that must be taken into consideration as well. Web 2.0 with its social networking capabilities, the

continued development of online professional learning communities, and new research on blended learning environments suggest that TPD design models must also draw from theories of distributed cognition, as well as Constructionism. Perkins wrote that distributed cognition is the “dispersal of intellectual functioning across physical, social, and symbolic supports (Perkins, 1992, p. 134).” If we consider what this might mean in TPD learning environments using digital media and social networking tools, there are effects *of* technology and effects *with* technology. Salomon, Perkins and Globerson (1991) argued that computers might be thought of as “partners” in cognition because computers can perform certain functions more quickly and accurately than humans. For example, complex mathematical problems, storing and sorting information and collating information are evidence of “partnering.” These are effects *with* technology, because they are the “empowerment that results when we have the technology at hand” to support our work. The effect *of* the technology is that this work can be completed in far less time and with more accuracy. In Globaloria, the effect *with* networked technology is that Globaloria staff, teachers and students can easily share their expertise and knowledge across learning contexts. The effect *of* networked technology is that teaching and learning become visible in ways not possible in non-networked environments.

In order to further organize the important dimensions of teacher learning into analyzable form, we draw from the seminal work of Bransford, Brown and Cocking. Bransford and colleagues argued that new findings on how students learn also apply to how adults learn, particularly when combined with activities that promote metacognitive reflection (Hammerness, et al., 2005). We build upon their work because we argue that social networking media in conjunction with learning by design helps teachers think differently about content, and we believe that thinking differently will help lead educators to effective change in practice. Although there are many well constructed models for TPD, there are not so many models that include networked learning contexts for teachers. I have chosen to use

the model described below because it keeps the needs of the teacher as learner up front in concert with technology, pedagogy and content.

I used a matrix adapted from the Dimensions of Effective Learning (DEL), developed by Bransford, Brown and Cocking (2002). The adaptation, Teacher Dimensions of Effective Learning (TDEL) draws from the research literature on how teachers learn as discussed in *How People Learn* by Bransford and colleagues, as well as from teacher professional development research literature (Whitehouse, 2006). It presents four research-based dimensions that must be present for effective teacher learning and provides a guiding framework for our research:

- **Learner-Centered Learning Dimension**
 - Teachers are active participants and are active partners in decision-making about TPD
- **Knowledge-Centered Learning Dimension**
 - Supports development of technological pedagogical content knowledge in context of the needs of the learners (TPACK + L)
- **Community-Centered Learning Dimension**
 - Supports teacher professional growth and development through professional learning communities and ongoing professional development
- **Assessment-Centered Learning Dimension**
 - Teachers collaborate by sharing experiences in teaching and provide effective peer critique of pedagogy and assessment practices

Table 1 lays out the TDEL as the dimensions intersect with the following variables: learners, pedagogy and technology. These variables were drawn from the work of Borko (2004) and are key design variables for teacher professional development. In Borko's work, the third

variable was context, and in this case, we have used technical design as the context because technical design decisions about the communication and digital media used are key factors in the teacher learning experience. Crossed with the Dimensions of Effective Learning, the variables create an analytic matrix through which to frame and explore the design of teacher professional development in Globaloria.

Table 1 Teacher Dimensions of Effective Learning (TDEL)

TPD Dimensions	Key Design Variables for TPD		
	Pedagogy	Teacher as Learner	Technical Design
Learner-Centered Learning Environments	Builds on strengths and needs of teachers; acknowledges the experiences and knowledge they bring or lack of	Active participant bringing their pre-existing knowledge and experience and learning goals to the learning context and to generate new goals	Supports sharing of ideas, experience, transparency and facilitating change and growth
Knowledge-Centered Learning Environments	Supports development of technological pedagogical content knowledge in the context of knowing the needs of the learner; building new mental models of teaching	Brings their own content knowledge and domain expertise; need to participate as learners rather than experts	Digital media that support building new mental models about practice; support building new domain/content knowledge connected to learning teaching strategies that are not about showing the way, but encourages educators to appreciate the difficulties and value of “getting stuck.”
Community-Centered Learning Environments	Establishes norms to form collaborative peer and stakeholder relationships; cultivate and supports action research on practice teacher as researcher and	Are part of an existing culture of learning and teaching in own school or professional context	Space to share/reflect on student work and teacher work; place to share successes and failures; shared discourse on data on student learning and

	teacher as learner. There is transparency.		teacher learning space to share/reflect on self learning. Stressing self learning and bring self-learning to student learning
Assessment-Centered Learning Environments	Provides opportunities to test new understandings of concepts, skills, products such as games; supports action research; self and peer assessment	Brings own ideas about how to give and receive feedback; often not experienced in giving effective feedback or in action research	Promotes/supports structured individual and group reflection and feedback; sharing of research findings and changes in practice

The matrix highlights important concepts of learning by design, such as process (building community, knowledge creation, and assessment) and products (games, tutorials, professional learning communities, etc.) that may contribute to theory and building new TPD models. The social networking tools that support teacher learning in Globaloria make it possible to see process and products as they are captured by participation in the wiki and other online working spaces.

Methods

The qualitative analysis was completed using the Educator Reports, and interview transcripts, as described below.

Educator Reports

The Educator Reports are a required element of the Globaloria Program, and teachers submit them on a quarterly basis. The reports are rich sources of data because they include demographic information and topics such as:

- Tracking of Globaloria Activities and Hours Spent
 - Teaching Hours

- Admin-Support Hours
- Self-Learning Hours
- Notes and Reflections

- Personal Progress
- Presentations, Demonstrations, Talks
- Progress Reports for each student
- Syllabus Topics and Tutorials Covered
- Open Feedback

Teachers are asked to reflect upon their activities as well as record the time spent on them. In this report, two sections of the Educator Reports were analyzed: Notes and Reflections and Personal Progress. The analysis was done using Atlas.ti qualitative research software, described in more detail in the next section.

Interview Participants

Five teachers from a variety of school settings were selected, using a maximum variation sampling technique derived from purposive sampling. Maximum variation sampling is meant to assist the researcher in unearthing the main themes of importance that cut across cases.

Patton argued that even a “small sample of great diversity...derive their significance from having emerged out of heterogeneity (Patton, 1990, p. 172).” Table 2 below lists the teacher participants, their school context, and their role in Globaloria. The main criteria for choosing educators to interview were one person per learning context, held the role of lead educator, and were completing either year one or year two (year three begins Fall 2009). I believe that the teachers most immersed in the process would provide the most valuable baseline data.

Table 2 Educator Roles and Context

Educator	School Context	Role	Subject
Educator A; year 2	Technical Center, formerly a vocational school	Lead educator (stipend paid) and mentor	21 st century learning and technical skills
Educator B; year 1	Rural middle school	Lead educator (stipend paid) and mentor	Language Arts
Educator C; year 2	Community Technical College	Lead educator (stipend paid) and mentor	Web design, technical certifications
Educator D; year 1	Urban high school	Lead educator (stipend paid)	Business
Educator E; year 1	Alternative placement school	Lead educator (stipend paid), and mentor	Computer Technologies

All participants are lead educators because they had the most immersive experience with Globaloria and most became mentors or leaders in technology professional development in their learning contexts. Future research will examine teachers who are not lead educators, and those who did not remain in the program.

Procedure

One challenge for researchers in rural areas is the long travel times, and often no cell or internet connections. In this case, since all participants were comfortable with online meetings, the interviews were conducted across distance. Interviews were conducted using GoToMeeting™. GoToMeeting™ provides audio (either by phone or VOIP), screen-sharing, and tools to record all audio and text chat. It is easily used by those with lower bandwidth, and requires only a headset with built-in microphone. Each interview lasted about thirty minutes and was transcribed using f4 transcription software compatible with Atlas.ti, a qualitative research software package.

The interview protocol was aligned with the TDEL (see Table 1) and questions were crafted to explore the teacher experience through the lens of each dimension. Learner, pedagogy and technical design are listed in parentheses with the appropriate question.

Table 3 Interview Protocol

Learner Centered Learning Environment:
1. Tell me about how you decided to participate in Globaloria. (learner)
2. Do you feel Globaloria has changed how you think about your teaching? (pedagogy)
3. Has Globaloria changed how you teach? In what ways? (technical design)
Knowledge Centered Learning Environment
1. Has Globaloria changed how you prepare for teaching? Examples? (learner)
2. Talk about the ways in which you now use new technologies in your teaching.

Examples. (pedagogy and technical design)
3. Does participating in Globaloria help you develop new teaching skills? (pedagogy)
Community Centered Learning Environment
1. Have you changed the way you work with other teachers? How? (learner)
2. Do you feel that Globaloria has had any impact on your school outside of your classroom? If so, how? Examples. (pedagogy)
Assessment Centered Learning Environment
1. Tell me about the ways that Globaloria has affected the way you assess student work. (pedagogy)
2. How do you assess your own teaching? Any new insights? (learner)
What lessons have you learned about teacher professional development? What advice do you have for professional development? (pedagogy and technical design)

After transcription, each interview was analyzed using qualitative research methods from a top-down and bottom-up approach. The top-down approach was structured from the dimensions in the TDEL, and the bottom up approach emerged during multiple readings and coding sessions. Two sections (Personal Progress and Notes and Reflections) of the Educator Reports (48 total) were coded in the same manner in order to add robustness to the analysis.

Data Analysis

Each interview transcription was loaded into Atlas.ti, and associated with its audio file so that the researcher could read the responses and hear them in the respondent’s voice simultaneously. Each Educator’s Report was loaded in Atlas.ti as well. Interview transcripts

and the report sections were coded using the three variables (learner, pedagogy and technical design) within each of the four TDEL dimensions to develop conceptual links to the matrix. Next, comparative coding derived from the constant comparative model developed by Glaser and Strauss (Merriam, 1998) found two major themes that emerged in each dimension: ***Change*** and ***Challenge***. A careful reading of the interview transcripts and reports and analysis using the Word Frequency tool in Atlas.ti identified the comparative codes.

Change refers to current changes in teaching modes, methods and assessment as described by the teachers. During the interviews, all teachers referred to key changes in their teaching, and in their thinking about teaching. These changes are generally resolved challenges and an action taken, at least for the time being.

Challenge refers to present and future challenges described by the educators. Challenges were generally centered around developing their coding skills in the computer programs used for game design, and on developing their pedagogy to best support students. They are generally unresolved and ongoing.

The Atlas.ti Query Tool was used to find all quotations associated with the terms ***Change*** or ***Challenge*** in each learning dimension. The query is set up by first identifying the operand (code family); for example, the Learner Centered Learning Environment (LCLE). The proximity operator, ***Change*** or ***Challenge*** is then set up to find all codes within each dimension: [Change within LCLE] or [Challenge within LCLE]. This proximity query was repeated for all learning dimensions. This heuristic allows a clear-cut path to examining ***Challenge*** and ***Change*** in the context of teacher learning, and is thus very useful because a central focus of this TPD research is to examine what types of TPD are necessary to respond to the shifting priorities of 21st century teaching and learning, and to learn more about the

contributions that Globaloria makes to this need. 142 text chunks were coded across all learning dimensions in the five interview transcripts. Table 1 provides the coding landscape:

Table 4 TDEL Coding Landscape

Learning Dimension	Total Text chunks coded	Change	Challenge
Learner-Centered	21	8	15
Knowledge-Centered	25	31	14
Community-Centered	55	16	8
Assessment-Centered	41	8	3

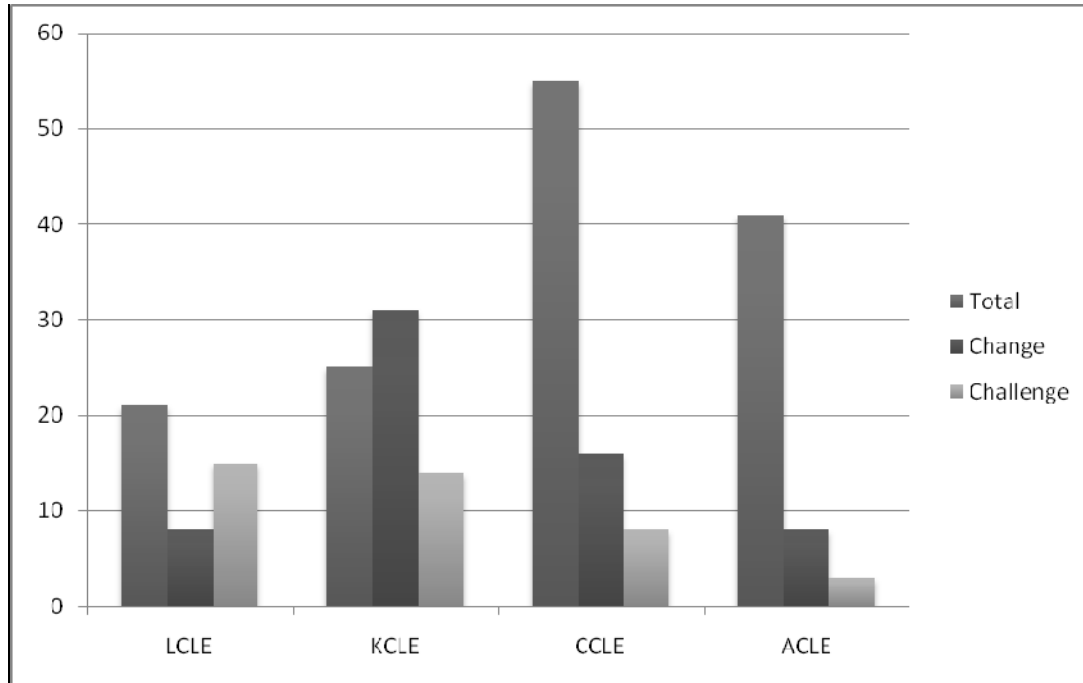
There are certainly limitations to these methods. First, it is not really possible to separate the TDEL dimensions into discrete categories—there is overlap between each. However, creating such a heuristic allows one to develop conceptual links that relate theory to practice in a useful way. Second, the comparison coding took place across a small sample size and one could argue that the themes that emerged may not hold true with a larger sample. Using the maximum sample variation method may support the robustness of the analysis, and this will be further addressed in the next round of interviews in pilot year three.

Results

In this section the overall findings from the dimensions analysis described in the previous section are discussed in light of the research questions that were developed for each dimension. **Error! Reference source not found.** below provides a visualization of the

overall coding scheme. It highlights the dimensions of teacher learning that were most discussed by the interview respondents and in the Educator Reports and highlights the interplay of *Change* and *Challenge* within each dimension. The quotes chosen are most illustrative of the common responses across the interview respondents and Educator Reports.

Figure 1 Overall Coding



The graph demonstrates the total number of coding chunks in each dimension, as well as the total number of coding chunks within that dimension that were also coded as *Change* or *Challenge*. The CCLE (Community-Centered Learning Environment) had the largest number of coding chunks, although the key points of interest are in the number of *Change* or *Challenge* responses because those highlight the areas where teachers have taken action and areas where teachers are still working to find solutions. The findings are discussed in the context of the research questions developed for each dimension.

In the Learner-Centered Learning Environment (LCLE), the two research questions developed for this dimension were:

- What attitude shifts towards technology, pedagogy, and content knowledge do educators experience as a result of participating in Globaloria?
- How and to what extent do educators change their teaching strategies as a response to new thinking about their learners?

Teachers spoke of their Globaloria experiences in terms of *Challenge* more frequently than *Change*. The challenges often were described in relationship with the discomfort all teachers reported as they moved into the new and uncomfortable role of being learners and learned how to get the support they needed. The quotes below help illustrate the *Challenges* teachers expressed as they developed new thinking about their pedagogy, technology, and learners:

I believe that I have learned as much if not more than my students, through my students and then independently on my own, because I had to learn to reach out and ask for help, and hey, it's okay, because we are all learning this together...

They set it up wonderfully; they had us be the learner for our first three days [of Globaloria Academy]. I remember leaving every evening thinking I'm just so overwhelmed and what am I going to do?

It has been humbling for me because I can usually pick up on things very quickly...It has left me feeling that I have let the class down, and that bothers me. I don't like not knowing how to help at every step. That is hard for me to admit.

The teachers reveal a degree of angst about their learning that is familiar to most that have entered a new learning environment and are introduced to very unfamiliar gaming and computer language. Interestingly, the teachers were more concerned about whether or not they could give their students what they needed, rather than challenging the need for these

changes. The *Changes* they discussed in the interviews were very connected to the *Challenges* because they further highlight the changes that teachers felt they must make in their own practice as learners and as professionals. The quotes below help highlight the changes teachers made, or attempted to make in their own practice.

I think I had stepped down to be this ultimate authoritarian in the classroom to be a facilitator, and that took me a while just to realize that was okay. It is okay to let the students see everything. That was the biggest thing about being uncomfortable with the technology that you just have to know it all, but you don't have to really.

Like, if you had any questions, I would not go and ask, because I am not that kind of person, but I would go and sneak and look at what they (teachers) are doing and look at their files, and I kind of like to borrow stuff and really really helped me to establish my own practices.

Traditionally, I was more of the stance that each student needed to do their own work, and I was very rigid in no discussion happening in class. It's okay if your students do know new things and it kind of has to be that in your classroom that you are no longer the teacher to the student...you're more of a student yourself...more of a collaborator.

The teachers discussed very fundamental changes that they have had to make in attitude and actions as a result of their participation in the Globaloria Program. Moving from the direct instruction/lecture-based teaching model to a facilitator/adaptive expert model is a very profound change, and one that needs more analysis and follow up for Y-3. It will be very important to know to what extent these changes endure.

The themes of *Change* and *Challenge* for teacher as learner continue in the Knowledge-Centered Learning Environment (KCLE). The research questions developed for this dimension are:

- How much knowledge of Web 2.0 skills and interactive game design are needed for teachers to most effectively guide student learning?
- Do teachers develop and extend their content knowledge and their domain knowledge as a result of guiding students through the game design process?

Error! Reference source not found. illustrates that teachers discussed issues around *Change* more frequently than *Challenge*. The changes mainly focus on teaching strategy shifts that are expressed as changes in the classroom and as changes in teacher thinking about the most effective ways to teach. Teachers did not talk about extending their content knowledge or domain knowledge and it will be necessary to ask this question directly in the next round of interviews.

It is important to remember that *Challenges* describe issues that are unresolved or yet to be met. *Change* describes actions that teachers have taken in their teaching and in their classroom management. The quotes highlight some of the issues connected to *Change*:

All of my classes are now on a wiki...and the students like it.”

“I have my students all do blogs. Every class and every student has their own blogs...I ask them essential questions each week and they have to blog about it, so they are reflecting on their learning, which I did not have them do before.

I let the students guide their learning more. I value their input a lot more that I used to because mostly what I say, that is what we do. Now I kind of let the students tell me what they would like to learn, tell me what they don't know and need to work on a little bit more.”

I introduce a lot more projects...I'm relinquishing my powers...letting them work a little bit more on their own...

I know at the time, they emphasized the wiki and I had never utilized the wiki itself as a learning tool with the classroom. But once I started using it, I embraced it.

Overall, teachers focused on integrating Web 2.0 tools more effectively into the learning process for themselves and their students. One apparent outcome of this shift in pedagogy is that the teachers began including student input into their planning, and used student reflections about their learning experiences to guide their planning. This signals an important shift in the process of moving from the direct instruction model of teaching to the facilitator/adaptive expert role.

The numbers of Challenges raised in the KCLE were significantly less than the number of changes, but signal some important issues that need further exploration. Two key issues emerged: access to computers in a timely manner that supports the needs of the students and teachers; the impact that teacher change has on student learning. It is also important to note what is not there—no discussion around content or subject domains, although this is partially a problem with the interview questions that will be addressed in the next round of interviews. The quotes that follow highlight the issues of access and impact on students:

I think sometimes we worry about the teachers having to change, but there are still a bunch of kids that are still struggling because the teachers are starting to change everything around. Not that it's bad, it's just different, and they suffer a learning curve.

The most challenging thing for me was when we began actually with the game design and all of the coding. Everything up until that point, I was absolutely fine with. And then I wondered how am I going to remember all of this and be able to explain it to my students because of their frustration levels....

We as teachers need to step back and take a backseat role in as many cases as we can, and allow the students to totally take ownership of their learning.

It does seem around here, it is a luxury to be able to utilize a computer lab for the time it's required to have it, although the weird stipulation is that the schools sign on to do the Globaloria program, it is there in black and white that these classes are going to require those labs...it seems schools forget about that...

Another challenge that I face seems to be time. I have requested a dedicated set of laptops next year through the stimulus package that we are receiving. I hope that we will be able to get them. I asked for the little laptops (netbooks?) so that I could keep them in my room. If this request goes through, I think I could accomplish so much more. It seems that with the class period we have that once we get the computers out and get started, that it's time to go! I usually forget to have them blog because they're so busy that time just passes by and it's time to take the laptops back to the lab.

The Educator Reports described the issues of timely access to computers that work and provide uninterrupted connection to the Internet most frequently. Several teachers wrote of

the difficulties of having the student population change frequently, as well as changes in scheduling that did not take into account the needs of the Globaloria program.

In the Community-Centered Learning Environment (CCLE) the research questions were as follows:

- In what ways does each educator participate and contribute to the growth of the Globaloria professional learning community?
- How and to what extent does participation in Globaloria impact teaching, professional development at the school, community, and state level?

As illustrated in **Error! Reference source not found.** there was a significantly higher response rate overall in this dimension, and most teachers discussed *Change* issues rather than *Challenge*. Teachers discussed how they now work in a more communal spirit with their students, and new thinking about their own professional development. The quotes that follow are illustrative of the most common changes described by the teachers.

There is a sharing, and I might adapt their idea to mine...So this is the first opportunity that I've really had where there's people I can share and borrow their ideas and adapt it to what I do...now it is this nice support group where we can get ideas from each other.

I know one teacher in particular...she also went to some TIS training, but most of it she picked up from hearing me, and she came to my room sometimes.

I have grown so much as a teacher and as a person and it has provided a vehicle for me to help my students in a way that I would never have recognized is available...it is most important to keep the lines of communication and support open.

I use the Educators' Wiki at this point for a lot of research. If we've got to submit something I go there for resources on what we need to do...it wasn't until they had me actually join the mentors' program that I really started to communicate a lot with instructors from other schools.

... our school held parent night, with Globaloria being of the presentation. Our principal wanted me to talk about this class and student learning. However, we have decided that nobody could give a better presentation than students themselves. Thus, the students volunteered to talk about their work and impressed parents a lot!

An important aspect of teacher learning in the Globaloria Program is the amount of professional development that participating teachers provide, formally and informally. The last quote above is illustrative of a formal way of sharing with parents, teachers and school administrators, and the second quote is illustrative of the informal TPD that quietly takes place in classrooms and lunchtime conversations. Both are aspects of TPD that need more exploration and analysis in order to better understand the nature of teacher learning and the durability of teacher learning.

The *Challenges* responses carry on the themes of learning to be a learner in a social networking context, as illustrated by the quotes:

Educators' Wiki was really helpful in the beginning of the course because I did not know much. It's such a different structure that it takes you a while to get used to it.

And the Wiki had all of these little tips, and it always offered the chance to connect to other educators.

I worried too much and needed to trust the Globaloria staff more...the kids' frustration level was not nearly what mine was...

...it's not all about you explaining content to somebody else, but it could very well be the fact that they are explaining to you as well. It's not a one-way street anymore. It's a two-way conversation.

It's hard to teach when there is so much going on and when the population changes constantly. Personally I am having a hard balancing everything. I do not get as much time for this as I used to.

This section highlights the big changes that teachers are struggling with—from learning with the classroom door “open,” to dealing with transient student populations. The last quote describes an issue that is somewhat context driven because the alternative schools participating in Globaloria do not function on the same schedule as the public schools, and the populations do change frequently.

The Assessment-Centered Learning Environment (ACLE) research questions are as follows:

- What best practices do each of the educators demonstrate in creating formative and summative evaluations of student work?
- How and to what extent do educators change their ideas about effective assessment of self, students and colleagues?

This dimension carries the themes of *Change* and *Challenge* forward from another perspective. As noted in **Error! Reference source not found.**, teachers discussed *Change* more than *Challenges*. The changes are characterized as observations about student learning, and self-learning.

Just their [student] blogging on the essential questions helps me identify teaching things they like and don't like.

...I use a rubric and they're given that in advance to say that this is what I am looking for...sometimes I use a rubric and sometimes I don't, but it is outlining what the kids need to do...

When my students do projects, one of the options I give them is to videotape an interview, act it out on videotape...instead of giving them just one mode of presentation...and they are happy with it.

I will actually go over and explain to my students what my expectations are, and I show them the rubric and the grading policy that has been laid out through

Globaloria...I encourage each of my students to make their own grading rubrics...

Two important ideas emerge from this series of quotes. The first is that teachers are giving students their learning goals and performance goals in advance, and in some cases even encourage students to create their own evaluations. The second is that students are given multiple modes of presentation and performance to demonstrate their levels of achievement of the learning goals. This is a key finding in terms of teacher change, and is closely

connected to the themes in the other dimensions that describe increased levels of student ownership and involvement in their learning.

In terms of *Challenges*, teachers focused on student learning issues:

...to allow students to work at their own individual level and encourage them to collaborate with their peers and not sit quietly in their seats. They need to talk with their peers, and my thing is that I am your boss. You don't always go to your boss as the first line of defense...

There were issues brought up about the teacher not having much control over what was put out over the Internet, and the safety of kids. With the wiki we have editing rights as well as the Globaloria supervisors...with the blog, unless the student fixes it so the teacher has editing rights, technically a kid could something on that blog that is less than desirable. That's something that I am going to be proposing this summer, that we take another really good look at it, it really kind of bothers me.

Throughout the quotes, there is interplay of the traditional direct instruction approach and the Constructionist approach. It is possible to "see" the changing ideas as the teachers explored in their talk and in their writing their experiences in becoming a learner and facilitator and how that impacts their students and their classrooms. An emerging strength of networked learning environments is that learning and teaching become visible in ways that have not been possible in the past. This visibility allows teachers, students and researchers to examine, analyze, and reflect upon important changes in thinking and teaching. It allows all of us to track changes in our professional and personal lives and to "see" our growth and development in new ways.

Conclusions

One of the key lessons learned from Globaloria's first two years is the power of networked environments for teachers and students. In an email exchange, one teacher said that she had never before seen the work of other teachers in such detailed and visible ways. The networked environment provided her with opportunities to learn from other teachers in ways she had never before experienced. She went on to say that seeing the work of other teachers, and having the opportunity to discuss that work gave her confidence in her ability to lead her students through the Globaloria program (personal communication, March 23, 2009). Although the experience of one teacher cannot be used to generalize about all teachers in Globaloria, we can use this as an indicator to help us understand how teachers learn in networked environments as more data is accumulated and analyzed.

As I have discussed throughout this paper from varying theoretical and analytical stances, making teaching and learning visible from design process to final product seems to be a key element in assisting teachers to reflect, revise and make fundamental changes in their teaching practice. The critical challenges teachers face are familiar—having enough tech savvy, enough time, access, equipment that works. The amazing changes that teachers report—becoming learners with their students, virtually leaving the classroom door open, learning by stealth (browsing class wikis), and virtual mentoring point the way to the future of 21st century networked TPD. Much more research is needed in the each of the Teacher Dimensions of Effective Learning to better understand the extent and durability of these changes.

Bibliography

- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3-15.
- Borko, H., Whitcomb, J., & Liston, D. (2009). Wicked problems and other thoughts on issues of technology and teacher learning. [Article]. *Journal of Teacher Education*, 60(1), 3-7.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2002). How people learn brain, mind, experience and school. Washington, D.C.: National Academy Press.
- Brown, J. S., & Adler, R. (2008). Minds on fire open education, the long tail and learning 2.0. *Educause Review*, (Jan/Feb 2008). Retrieved from <http://www.johnseelybrown.com/mindsonfire.pdf>
- Caperton, I. (2009). The case for Globaloria Network in West Virginia: Empowering West Virginia youth to create and collaborate online with a 21st century game-making curriculum. New York: World Wide Workshop.
- Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator*, 6(11), 38-46.
- Darling-Hammond, L., Bransford, J., LePage, P., Darling-Hammond, L., Bransford, J. D., & LePage, P. (2005). [Introduction]. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world* (pp. 1-39). San Francisco: Jossey-Bass.
- Dede, C. (2000). A new century demands new ways of learning. In D. T. Gordon (Ed.), *The Digital Classroom* (pp. 171-178). Cambridge, MA: Harvard Education News Letter.
- Dede, C. (Ed.) (2008) *International Encyclopedia of Education* (2 ed.). Amsterdam, The Netherlands: Elsevier.
- Glazer, E. M., Hannafin, M. J., Polly, D., & Rich, P. (2009). Factors and interactions influencing technology integration during situated professional development in an elementary school. *Computers in Schools*, 26(1), 21-39.
- Hammerness, K., Darling-Hammond, L., Bransford, J. D., Berliner, D., Cochran-Smith, M., McDonald, M., et al. (2005). How teachers learn and develop. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world* (pp. 358). San Francisco, CA: John Wiley & Sons, Inc.
- Harel, I. (1991). *Children designers: Interdisciplinary constructions for learning and knowing*. Westport, CT: Greenwood Publishing Group
- Harel, I., & Papert, S. (1991). *Constructionism*. Norwood, NJ: Ablex.
- Kafai, Y. B., & Resnick, M. (Eds.). (1996). *Constructionism in practice*. New York: Laurence Erlbaum Associates.
- Lave, J., & Wenger, E. (1991). *Situated learning legitimate peripheral participation*. New York: Cambridge University Press.
- Malone, T. (2004). *The future of work*. Cambridge, MA: Harvard Business Press.
- Merriam, S. B. (1998). *Qualitative research and case study Applications in education*. San Francisco: Jossey-Bass.
- Patton, M. Q. (1990). *Qualitative evaluation methods* (2nd ed.). Thousand Oaks, California: Sage.
- Perkins, D. (1992). *Smart schools*. New York: The Free Press.
- Perkins, D. (2009). *Making learning whole: How seven principles of teaching can transform education*. San Francisco, CA: Jossey-Bass.
- Rittel, H., & Webber, M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, 4(2), 155-169.
- Rudestam, K. E., & Schoenholtz-Read, J. (Eds.). (2010). *Handbook of Online Learning* (2nd ed.). Los Angeles: Sage.

- Salen, K., & Zimmerman, E. (2003). *Rules of Play: Game design fundamentals*. Cambridge, MA: MIT Press.
- Salomon, G. (1993). *Distributed cognitions: Psychological and educational considerations*. New York: Cambridge University Press.
- Salomon, G., Perkins, D., & Globerson, T. (1991). Partners in cognition: Extending human intelligence with intelligent technologies. *Educational Researcher*, 20(3), 2-9.
- Senges, M., Brown, J. S., & Rheingold, H. (2008). Entrepreneurial learning in the networked age. *paradigmes*, 1(1), 125-140. Retrieved from http://www.gencat.cat/diue/doc/doc_52863486_3.pdf
- Wayne, A. J., Yoon, K. S., Zhu, P., Cronen, S., & Garet, M. S. (2008). Experimenting with teacher professional development: Motives and methods. *Educational Researcher*, 37(8), 469-479.
- Wenger, E. (1998). *Communities of practice*. Cambridge, UK: Press Syndicate of the University of Cambridge.
- Whitehouse, P. (2006). *Online teacher professional development: A MUVE toward the future?* , Harvard Graduate School of Education, Cambridge, MA.