Integrating Online and Face-to-Face Professional Development: A Social Networking Approach

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The Problem

Across all grade levels and populations, many teachers want to share and collaborate with colleagues, but remain isolated within their own classrooms. Teachers have identified isolation as a barrier to change in instruction (Lotter, Harwood, & Bonner, 2006). By contrast, collaboration can foster innovation among teachers, and even improve student learning in some cases (Goddard, Goddard, & Tschannen-Moran, 2007).

The development of Professional Learning Communities (PLCs) seeks to address the learning needs of teachers by creating "communities of professionals caring for and working to improve student learning together, by engaging in continuous collecting learning of their own" (Hargreaves, 2008, p. ix). In a study by the National Commission on Teaching and America's Future and WestEd, Fulton, Doerr, and Britton (2010) provide a synthesis of literature on STEM PLCs and conclude that they are universally recommended, although with varying cautions for their implementation. For example, having protocols for group functioning as well as facilitation, administrator support and trust-building are critical factors in a successful PLC. Overall, they found that participation in PLCs can be successful in engaging teachers in discussion about content knowledge and pedagogy, positively impacting their preparedness to teach content. This leads to teachers paying more "instructional attention to students' reasoning and understanding," as well as including "more diverse modes of engaging student problem-solving" (p. 8). Compared to face-to-face professional development, online PLCs have a stronger need for facilitation in order to get participants engaged in discussion of larger pedagogical issues (Fulton, Doerr, & Britton, 2010). Garrison and Arbaugh (2007) developed a community of inquiry framework to guide research and practice of online learning, which applies to professional development courses. This framework describes the social, cognitive and teaching presences needed for successful online learning. A model of the framework is shown in Figure 1.

In Garrison and Arbaugh's model (2007), social presence is the "ability of learners to project themselves socially and emotionally, thereby being perceived as 'real people' in mediated communication" (p. 159). Collaborative activities that encourage social presence also increase the participants' satisfaction with the course. Garrison and Arbaugh state that "although social presence alone will not ensure the development of critical discourse in online learning, it is extremely difficult for such discourse to develop without a foundation of social presence" (p. 159-160). Cognitive presence is "defined in terms of a cycle of practical inquiry, where participants move deliberately from understanding the problem or issue through to exploration, integration, and application" (p. 162). An ideal online course would enable participants to complete this cycle. Successful social presence can enable the higher-level discourse to increase cognitive presence. Lastly, teaching presence is necessary to provide parameters and focus in the course. Teaching presence includes instructional design, organization, facilitating discourse, and direct instruction.

Figure 1: Community of Inquiry

Reprinted from "Researching the community of inquiry framework: Review, issues, and future directions," by D.R. Garrison & J.B. Arbaugh (2007). *The Internet and Higher Education, 10,* p. 158.

There are several advantages in online PLCs versus face-to-face professional development. Discussion in online PLCs often may have greater focus on pedagogical content knowledge than face-to-face PLCs because participants online often do not share students or classroom settings (and thus need to focus discussion on other topics). There is the obvious advantage of not being limited to time and place in order to participate, although this may have a disadvantage in regards to making it easier for teachers not to participate fully. A panel of experts felt that technology can be a great support for face-to-face professional development, making it "possible for conversation to continue after and between meetings" (Fulton, Doerr, & Britton, 2010, p. 41).

Overall, the development of well-organized PLCs has been beneficial to teachers, and can be especially successful online when well-facilitated. Rovai (2002) found that feelings of community were related to interactivity in online courses, "thus emphasizing the importance of dialogue over structure." This is similar to Garrison and Arbaugh's research (2007) stating that social presence is a critical part of creating an online community of inquiry. Thus, the PLC with social networking capabilities can defeat the isolation of teachers and allow them to improve their practice through collaboration with peers by incorporating these elements into the material. boyd and Ellison (2010) define a social network as

> *Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system (p. 211).*

This project describes the development of one PLC, specifically geared toward incorporating software with models and probes into science curriculum. The specific platform used to deliver the course is called ELGG. Gray and Smyth (2012) studied a PLC developed on the ELGG platform for sharing resources across Edinburgh Napier University in the United Kingdom. This PLC was created to fill a need for educators to share ideas and remain connected to colleagues. The most used features of ELGG were the groups and forums. This indicates that connecting and discussing with colleagues were the parts of the platform that teachers found most valuable, as opposed to other features related to content sharing, such

as blogs or storage files. This ability to connect with colleagues was also helped by the use of avatars, small pictures that users included in their profiles, which increased the personal feel of the connections. These features allow participants to increase their social presence within the course.

ITSI-SU

The Innovative Technology in Science Inquiry: Scale Up (ITSI-SU) introduces technologies such as probes or sensors and computer-based models into the classroom. This comprehensive innovative technologies project assists teachers in preparing diverse students for careers in STEM (science, technology, engineering, and mathematics) by engaging them in exciting, inquiry-based science activities that use computational models and real-time data acquisition. All of the STEM activities involve asking questions or defining problems, using models or sensors, collecting data, interpreting results, using mathematics, technology and computational thinking, constructing explanations and designing solutions based on evidence.

Participating research teachers are a part of an online educational community where they have access to outstanding science exemplars. They are able to create and modify activities based on their own curriculum and objectives. They receive over 75 hours of lab-based activities in engineering, physical science, earth science, and life science for grades 3-12 and full support for classroom implementation.

The Centers and Participants

The project established four statewide Centers that recruit teachers for the ITSI-SU program. An institution experienced in professional development hosts each ITSI-SU Center. Each center has the resources to continue to offer ITSI-SU training. The Centers were selected because they serve low-income, minority, and rural students in their states. The Center based in Anchorage, Alaska, is located in the state's largest school public school district, but recruits regionally throughout the state with teachers participating from remote villages. The Iowa Center is located at the Heartland Area Education Agency in Des Moines that provides statewide professional development and especially dedicated to online digital curriculum. The KU Center for Science Education on the campus of the University of Kansas in Lawrence serves teachers from 286 school districts that range in size from the smallest district in Lane County with 69 students, to the largest district (Wichita Public Schools) in Sedgwick County with approximately 49,000 students. The Virginia Center is run from the Central Virginia Consortium for Transforming Teaching and Learning Experiences with Technology, which has statewide reach. The ITSI-SU project funds each Center to provide the program for 138 teachers in three cohorts across four states. The first cohort began in the summer of 2010, with each new cohort starting in each of the following two summers.

Professional Development in ITSI-SU

This project provides approximately 79 hours of structured activities to accomplish the following goals:

- **Goal 1**: A teacher should be able to select an activity or unit and teach with it. This allows a teacher to search the activity portal to find an appropriate exemplar activity that matches their state standards and then to use the teacher portal to register students, launch and complete the activity, and monitor student progress. This can be accomplished in one day or 7 hours of PD.

- **Goal 2**: A teacher should be able to create an instructional unit from activities. This allows a teacher to identify a standard and instructional level, select several appropriate activities, customize the activities so that they work well together, and provide an integrated context for the unit. This requires an additional three days or 21 hours.
- **Goal 3**: A teacher should be able to improve an existing activity by customizing it. This allows a teacher to use the online editor to customize and become familiar with the science and pedagogy of the activity, and make reasoned changes in the activity in order to better meet the needs of students and the curriculum. This requires an additional three days or 21 hours.
- **Goal 4**: A teacher should be able to collect student data and use the results to revise their activities. This allows a teacher to collect student performance gains using the assessments in activities, analyze these data for evidence about strengths and weaknesses in the activities, and list and implement the desired changes. This requires an additional four days or 28 hours.

The professional development consists of:

- A **week-long (35 hour) summer workshop**. This focuses on goals one and two and introduces goals three and four.
- Two **five-week online courses during the following academic year (30 hours total).** The first course completes goal three and the second course covers the data collection and analysis part of goal four.
- A two-**day face-to-face workshop in the second summer (14 hours).** This workshop completes goal four.

All participants have access to the ITSI-SU student activities and are part of an online community for sharing news, ideas, problems, and successes. Teachers received $1,000 stipend in two parts. When they completed the first summer workshop and created their first activity, they received half of their stipend. The balance was paid at the end of the second summer when the report on the second activity was submitted and accepted.

Online courses

ELGG is open-source, social-networking software with profiles, discussion groups, blogs, online friends, and polls that was easy to configure for professional development purposes. We easily configured blogs and discussions to be threaded into the site. In addition to public postings, each teacher has the option to have private messaging through internal ELGG email that is only viewed by the sender and recipient.

Teachers shared their customized activities within their personal blogs. Peer review rubrics that allowed teachers to review and comment on ten different criteria about their colleagues' activities were embedded within the online courses. Using green (good), yellow (tweak), and red (rewrite) light options for each of the components of the review, teachers could provide valuable feedback on the activities. As one Iowa teacher commented:

> *I was trying to ask if there could be something like this available beyond the course, as I intend to keep making/tweaking activities beyond the scope and time of this course. Peer feedback is one of the great things missing from the vast majority of individual teacher efforts and is one of the greatest strengths of how you've designed the ITSI-SU courses (clear instructions and good materials and practicality of assignments and the fact that all of this informs education research are just a few of the other strengths of this program). -Middle school Teacher, Iowa, 2012*

In addition to peer review, each teacher was asked to share a VideoPaper (vpb.concord.org) and blog around their classroom use of activities in their classroom.

Research Questions

While ITSI-SU is a broad project with multiple areas for research, the current study focuses on questions related to the use of the blended professional development. Specifically,

1. How does participation in the online course differ from a similar course offered on a platform without the same social networking capabilities?
2. What is the depth of teacher participation in the online course?
3. What do teachers feel was most successful for them in the ITSI-SU professional development program?

The first question relies on data from the original ITSI project (the predecessor to the scale up) in 2007-2008, in which online workshops were conducted on a different platform (Moodle), which was less of a social network as it had fewer of the communication tools contained in ELGG. This was compared with data from the 2011-2012 online courses in ITSI-SU. The second question can be answered with teacher responses from the most recent fall online course (2012) as well as some data from the comparison with Moodle (2008). The final question will be answered with teacher responses to surveys about their experiences in the professional development program, both online and in person.

The professional development for both ITSI (2008) and ITSI-SU (2012) concentrated on training the teachers face-to-face in the summer prior to working with students. In the case of ITSI, teachers were involved in eight days of a workshop within their school district, two five-week online courses in Moodle during the school year and four days of a follow-up summer workshop in their district. Only three school districts were involved in the project, one from California, one from Kansas, and one from Massachusetts. For ITSI-SU, teachers were involved in five days of a workshop within their state, two five-week online courses in ELGG during the school year and two days of a follow-up summer workshop in their state. Individual teachers are recruited by Center Directors from four states (Alaska, Iowa, Kansas, and Virginia) and multiple districts are involved in the training.

Each of the asynchronous online courses covered the same material with an online moderator providing weekly tasks. The fall online course reviewed accessing the portal, customizing materials, viewing student reports, and the importance of using computational models within a science classroom. The spring online course had the teachers discuss the relevance of using sensors in the science classroom to collect and display data. Teachers also used the private and secure VideoPaper Builder (http://vpb.concord.org) to share and reflect on their teaching through video. During each of the online courses the teachers were asked to share a customized activity that they are using with their students and to participate in the peer review process with their colleagues. In both ITSI and ITSI-SU, the teachers were given more flexibility during the final course to upload video and design tips and receive advice from other teachers with whom they shared their video.

Results

Question 1: How does participation in the online course differ from a similar course offered on a platform without the same social networking capabilities?

As previously explained, data was compared between the ELGG course in 2011-2012 and the Moodle course in 2007-2008. The materials and expectations were the same between the two courses. The ELGG course had 100 teachers from four states and three grade levels (elementary, middle, high school) whereas the Moodle course had 90 teachers from three school districts (Boston, Desert Sands, and Olathe) across two grade levels (middle and high school). Within both courses, teachers were expected to comment on particular topics or reading materials provided to them. In the ELGG course, 92% of teachers participated versus only 63% of teachers in the Moodle course. A striking difference between the courses was the number of comments made across grade levels or states. In the ELGG course, participants made on average 8.99 comments responding to a participant from another state, whereas only 2.77 comments were made in response to someone from another state in the Moodle course, despite the fact that the number of overall comments made was approximately equal across platforms. (Initial results from the fall 2012 course indicate that this trend continues in this year's (2012-2013) courses, with a mean of 6.17 comments per teacher made in response to a teacher from a different state. If this trend continues, teachers will have made more than 12 comments in response to a teacher from a different state by the end of the spring course.) Additionally, a few ELGG teachers made comments across grade levels (1.33 on average) whereas no students in the Moodle course did this, indicating they did not explore the website beyond the forums they specifically needed to use for their course. Comments by the Moodle teachers also were more likely to be off-topic than those of the ELGG teachers (0.67 versus 0.19 on average). Off-topic comments would be unrelated to the course materials, such as discussion of sports or weather.

boyd and Ellison (2010) described creating a profile as an important part of defining a social network. In both ELGG and Moodle, teachers had this option, but the ability to include pictures and more detailed information was easier to use in ELGG. This ease of use was made clear by the number of teachers who chose to do so. Ninety-eight percent of teachers in the ELGG course filled out a profile at least partially, while 72% of participants in the ELGG course had a complete profile with verbiage about themselves and a shared picture. By contrast, only 45% of teachers in the Moodle course added anything at all to their profiles.

Question 2: What is the depth of teacher participation in the online course?

To examine depth of participation, length of teacher responses is examined in addition to quantity of login days, comments, and reviews of activities. Analysis of online course participation from the 2012-2013 school year has been completed for the five-week fall course. The spring course is concluding in March 2013, thus analysis has not yet begun.

In the fall course alone, teachers made 25.7 comments on average, which is more than teachers in both fall and spring courses combined in the previous year (23.8) , indicating that this year's cohort is already exhibiting more participation. Their comments were also examined by number of words. On average, a teacher made 11.1 comments that were 40 or fewer words long, 6.6 comments that were 41 to 80 words long, and 5.5 comments that were 80 words or longer. This indicates that teachers are not just making quick comments, but about half of the time they are expanding on ideas from the course materials or in response to comment of other teachers in the cohort.

As part of both Moodle and ELGG courses, teachers were expected to share two activities that they developed individually, as well as to review activities shared by other teachers. Neither of these goals were fully met in the Moodle course or the 2011-2012 ELGG course, but there was much more success in the ELGG course where 48% of teachers shared an activity versus 20% of teachers in the Moodle course. As for reviews, teachers in the ELGG course reviewed an average of 1.63 activities, but no teacher reviewed any activities in the Moodle course. Looking at the results by grade level shows that elementary teachers were much more engaged in this process, as shown in Figures 2 and 3.

Figure 2: Percent of teachers who shared at least one activity by grade level

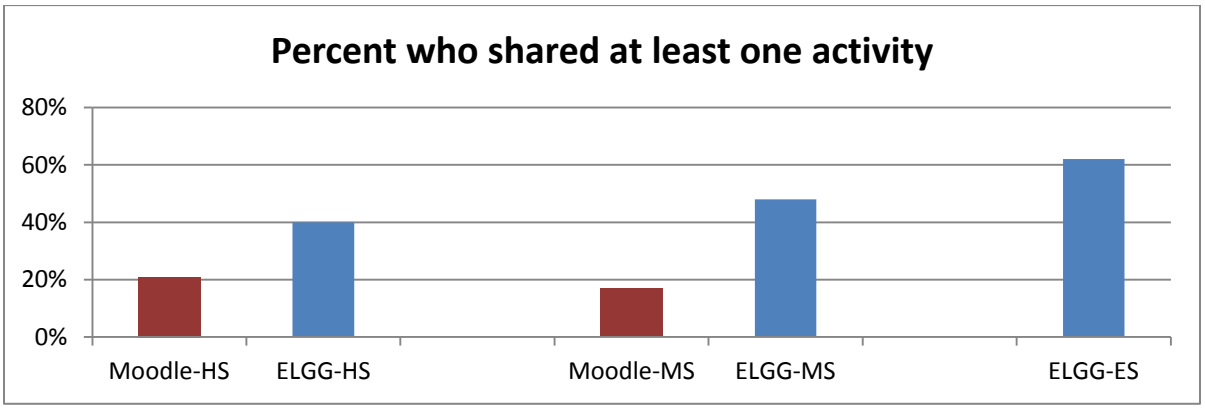
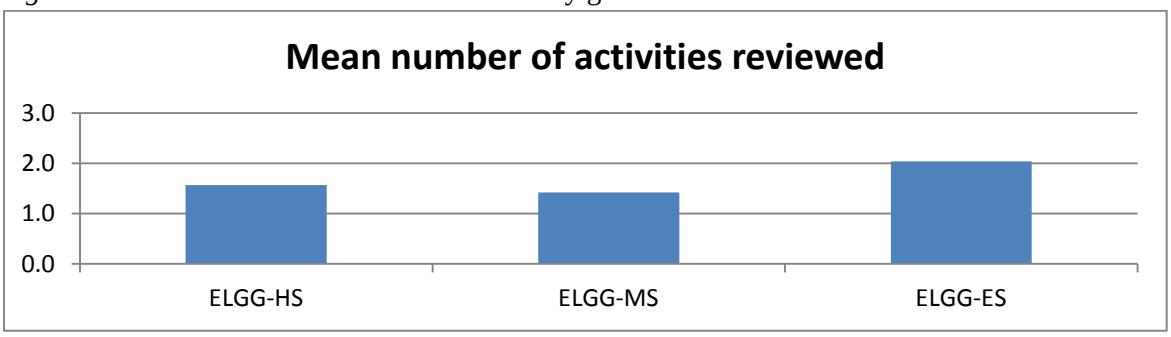


Figure 3: Mean number of activities reviewed by grade level



Through the fall course 2012, already 50% of teachers have shared at least one activity in the ELGG forums, indicating that sharing will be a much greater part of this year's courses. Additionally, two thirds of teachers have reviewed at least one activity of another teacher. The reviews consist of a form in which teachers can rate different categories as "good," "tweak," or "rewrite." These categories included questions on activity engagement, standards alignment, use of technology, use of inquiry, grade-level appropriateness, and so on. In addition, teachers were asked to comment on their ratings. The mean number of words used in each review was 92.0, with many teachers using well over 300, indicating that reviews were detailed in their suggestions to other teachers.

Question 3: What do teachers feel was most successful for them in the ITSI-SU professional development program?

Fulton Doerr, and Britton (2010) identified five key factors for a successful PLC.

1. Common vision and shared values for student learning, so that all members of the PLC work to solve problems around that vision.
2. Collective responsibility to share expertise, as well as a sense of accountability for student learning, connecting with their own professional learning.
3. Leadership support, so that members have space and time to meet, but also a climate of trust, empowering members of the group to make decisions.
4. Good facilitation to provide knowledge, process, and focus
5. Use of data and student work, including observing others teaching and providing feedback. (p. 47-48).

Teachers' opinions about the professional development provided in ITSI-SU were collected at different points throughout the courses. This included surveys after the face-to-face sessions, surveys given after each online course, and teacher responses within the online course. Their responses indicate their innate understanding of what makes professional development being very similar to the five key concepts from Fulton, Doerr, and Britton (2010) described above. Below are some examples of these responses.

Common Vision and Shared Values

Teachers reported that meeting other teachers with common issues was helpful to them both for support and for constructive ideas. These teachers all had the goal of bringing what they learned through the courses back to their classrooms. When teachers were asked how valuable interaction with other teachers was in the online course. 27% of teachers said it was "the best part of the course", while an additional 54% said it was "very valuable."

> *Having other teachers to talk to, bounce ideas off of, share ideas with, commiserate with, and reflect with was beneficial in innumerable ways. Additionally, I made contacts that helped me in using probes, finding and using lessons, creating activities, and beyond into so many other areas of my classroom. Meeting and talking to other teachers is something we honestly don't get much opportunity to do. Too often we spend so much time in our classroom with students, we never have the chance to meet and greet with other teachers. –Elementary School Teacher, Virginia, 2013*

> *It was fantastic to see that other teachers face the same challenges that I do, and value their student's successful learning experiences the way that I do. I really appreciated the insights and wisdom of other teachers as they commented on experiences and reflected on their own teaching. –High School Teacher, Alaska, 2013*

Collective Responsibility

Teachers in the ITSI-SU courses took seriously their responsibility to share their work and to provide feedback for others. Much of this sharing took place through creating video papers. Teachers noted that through creating these papers they were able to reflect on their own practices as well as receive the feedback of others.

> *I felt having teachers that are in the same area of study review your activities, I received great feedback. I am a new middle school science teacher and I have met some fantastic teachers who are a great resource for ideas in science. –Middle School Teacher, Iowa 2013*

I reviewed [teacher name]'s video paper about molecular modeling... and saw so many things that are similar to what I saw in my classroom! ...The point behind this is that I feel like I can learn how to better implement ITSI-SU activities in my own classes by watching how hers interact with them as well... refreshing! – High School Teacher, Virginia, 2013

I think it's great for participating in what has now been labeled PLC, we used to just call it sharing. We didn't have a particular place for it. We shared in the hallways, we shared as we had meals together, we shared while we were riding the buses on field trips and we shared while enjoying beverages. No one needed to tell us, it was instinctive. VideoPaper, a new technology to many of us will help us carry on the tradition. -Middle School Teacher, Virginia, 2013

Leadership Support

While school leadership was not directly involved in the ITSI-SU professional development, it was clear for many teachers that the support of that leadership was critical to their participation. As the courses went on, many teachers wanted to share their work through the courses with their principals as part of their evaluations. While the option to share work with administrators was useful to some, many teachers still appreciated the distance between what they did in the course and their in-school evaluations.

Also, I am using this ITSI-SU course as a part of my individually tailored professional learning/evaluation plan, and would like to include the video as part of my documentation. Is there a way to "share" it through a link or something that I can upload to the evaluation system so that my administrators can read it? - High School Teacher, Virginia, 2013

I know that I will learn more with teachers in an online environment. For some reason, there seems to be "safety" with online-more than in my own building. –Middle School Teacher, Iowa, 2013

Good Facilitation

When asked about the features of the online course that were most valuable, 96% of teachers identified the discussion forums. These forums not only allowed for interaction between teachers, but were guided by the course facilitators, so that discussion stayed on target, and teacher responses were supported and encouraged.

They were very encouraging. It was also nice to connect with people over the summer that had similar challenges (socioeconomic populations, admin support, access to probes etc) and then reconnect with this over the blogs and online course. It helped to have others that were dealing with the same issues support you and give you feedback! – Elementary School Teacher, Virginia, 2013

Use of Data and Student Work

ITSI-SU had numerous ways in which teachers would monitor their activities and student progress. This included teachers own lessons and modifications which they could share with others. But it was sharing their video papers that many teachers found the most valuable.

Creating the video was a lot easier than I thought it would be…I was also surprised how much I enjoyed the reflection and looking back to analyze how the lesson went. While I usually evaluate what I have taught the class and whether a particular lesson was effective, using the VPB, really made me take a good look at the effectiveness and called into focus how engaged the students were. It energizes me to do more of this type of lessons so that the students are active learners instead of little shells waiting to be filled. – Elementary School Teacher, Virginia, 2013

I think the viewing of a video paper will really help me further understand where students struggle with some of the material in my classroom. In the moment of teaching, it is often easy to miss small cues that would give insight into a student's struggles. It is my hope that by viewing the completed video of my teachings that I can learn to spot these moments in the video and improve my ability to identify them as they happen. This should hopefully help me increase understanding and the engagement level of all of my students. – High School Teacher, Kansas, 2013

Isn't it strange how seeing the kids after the fact in a video like this can tell you so much? I mean, it is from the same perspective as you usually have, but when you sit down later to watch them, you see so much more, and you see it in a different way. Wouldn't a yearly PGEP (Professional Growth and Evaluation Plan) be much more beneficial to all teachers if we chose something to focus upon improving, and then took a video of our room and reflected on how it showed that area of our professional growth? MUCH more helpful to us than endless data or testing or book groups, etc. Just a thought! –Elementary School Teacher, Virginia, 2013

Additional Teacher Feedback

The Blended Approach

There was much positive feedback about both the face-to-face and online portions of the professional development, but it was also clear that the combination of both increased the benefits of the courses to the teacher participants. By including a face-to-face portion, teachers felt more connections with at least some of the participants in the online course. But without the online course, teachers might not have continued with what they learned from the face-to-face sessions.

The summer course was a critical component of the program. Without the time allowed over the summer to become familiar with ITSI-SU, review lessons and write/modify lessons, the online portion would have been overwhelming. The online course was set up in manageable segments with terrific support and encouragement from the staff. –Middle School Teacher, Virginia, 2013

Both components were equally important. I might not have used the ITSISU program as much if I didn't "have" to via the online component. –Middle School Teacher, Virginia

Learning how to use the ITSI-SU activities and the VPB was wonderful, practical, and above all very useful. However, I felt at the end of the summer program, and still feel the same now, that the summer program was one of the best learning experiences I have had for over 10 years. – High School Teacher, Iowa

Implementing What Was Learned

Of course the goal of any professional development program is to affect what happens in the classroom on a daily basis. Many teachers indicated a desire to continue with what they learned in the ITSI-SU program, both by using ITSI-SU activities and materials, and by maintaining the connections they had made with other teachers and continuing the sharing.

> *I have created a network of science teacher friends to bounce ideas of off, because in my school I am the only high school teacher, so I need to find others for input and I found them. –High School Teacher, Iowa*

> *My goal is to make my classroom experience as digitally friendly as possible. Giving the students, parents, colleagues and administration an opportunity to peer into my classroom and see what my students and I are accomplishing on a daily basis. Most importantly of all providing the best learning environment possible for my students. –Middle School Teacher, Virginia, 2013*

> *I will be more conscious of how I ask questions of students...stimulating them to inquiry rather than 'feeding' them answers. –High School Teacher, Virginia*

> *I plan to continue to expand my use of probeware, both with and without ITSI-SU lessons and to periodically video my lessons for analysis and professional growth. –Middle School Teacher, Virginia*

> *I plan to continue to use the ITSI-SU activities, the probes I have learned about, continue to keep in touch with the colleagues I have made professional contact with, and continue to teach my students about STEM careers and make real-world connections for them to make science meaningful! –Elementary School Teacher, Virginia*

Conclusions

Overall, we have reached the following conclusions about the use of professional development in the ITSI-SU project.

1. Successful professional learning communities result from an organized cohort of teachers devoted to a common goal with sufficient guidance and facilitation.

Fulton, Doerr, and Britton's (2010) five key factors for a successful PLC were articulated by teachers within the ITSI-SU professional development. The common vision and shared values enhanced the feelings of community among teachers who had not necessarily met in person. These are also teachers who had the common goal to integrate technology (specifically probes and models) into their teaching and were eager to exchange ways to do that. All teachers took responsibility for sharing their expertise with others in order to explore the best ways to enhance student learning. The climate of trust within the community increased teachers' willingness to share. Facilitation both in person and online kept the activities of the PLC focused. Data in the form of shared activities and video papers gave teachers the opportunity to provide feedback and learn from each other.

2. Blended professional development involving both face-to-face and online social networking components increases the PLC's value to teachers.

It is clear that the online course used as part of ITSI-SU meets the definition of social network set forth by boyd and Ellison (2010). It does allow users to create their own profile including as much or as little information as they see fit. Users are also able to find other users with similar interests through the discussion forums. The system also allows users to navigate beyond their starting forums. This has allowed for discussions crossing both state and grade levels. While the success of ITSI-SU can in large part be credited to its ability to create social presence, cognitive presence, and teaching presence as defined by Garrison and Arbaugh (2007), it is also clear from teachers' responses that blending online and face-to-face professional development led to greater success in teachers' use of ITSI-SU activities. By beginning with a face-to-face introduction to the materials, teachers felt more prepared for the online courses. But the use of online courses better enabled teachers to build on what they had learned during the summer PD session, especially as the social networks embedded in the online courses maintained the sense of community that had begun during summer workshops.

3. Connections between teachers are strengthened by sharing and reviewing both activities and video papers.

Based on teacher responses, the ability to share their own lessons as well as videos of their own classroom was the most helpful part of the class. This allowed teachers to receive feedback from teachers beyond their school about their classroom activities. It also allowed them to evaluate their own performance and that of others, to develop best practices that they could translate back to their own classrooms. These activities were completed much more often in ELGG with its increased social networking capabilities than in the previous course with fewer social networking options.

4. The established PLC can be a source of ongoing professional development using the expertise of experienced teachers.

It is clear from teacher responses that they value the professional development gained through participating in the ITSI-SU research, and many would be interested in maintaining the PLC beyond the scope of their expected participation. In fact, many teachers from earlier cohorts of ITSI-SU continue to use ITSI-SU and participate in the online courses beyond their original commitments to the program. In addition to 210 research teachers who have participated over three years, there are also 178 teachers who have registered for ITSI-SU on their own. These teachers may also benefit from participation in the PLC. Thus, a central strategy for scaling up the ITSI program is to train and certify a cadre of trainers who can offer the ITSI-SU professional development program nationwide. We plan to do this by providing grant-supported trainer training for 25 master teachers. These master teachers will be selected from previous professional development participants who have shown greater quality and quantity of participation. They will then receive additional training to aid them in offering this professional development to teachers beyond the research study who are willing to cover their own costs.

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