

The Technology Core Teacher Community: Considerations for a Community  
Approach to Professional Development and Technology Integration

by

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## ABSTRACT

The purpose of this project was to research the effects of a professional development intervention designed to build local capacity for technology integration among teachers at the school level. This was done by providing focused face-to face and online training to twelve teachers referred to as the Technology Core Teacher (TCT) group. This project utilized the theoretical framework of social learning and communities of practice to provide an environment of ongoing support for technology integration. The findings addressed four areas: the TCT teachers' practice, their technology skill levels, the use of the online collaboration tools utilized for collaboration and virtual synchronous meetings, and whether the TCT teachers demonstrated signs of being a self sustainable community of practice. The findings demonstrate that the intervention had an influence on the participating teachers' practice and influenced the practice of other teachers as well. TCT teachers increased their skills when applying new learning with their students. TCT teachers used online collaboration tools minimally for communication, and synchronous meeting tools presented some difficulties. TCT teachers showed signs that they may be a sustainable Community of Practice. Although teachers reported that their technology skills increased, a pre-post survey of skills based on the ISTE NETS-T Assessment yielded lower confidence scores after the intervention. A follow up survey designed to explain these results indicated that teachers rated their skill set lower in light of more knowledge, indicating a possible paradox in self reporting of skills prior to awareness of technology based learning possibilities.

## DEDICATION

This project is dedicated to my three daughters who patiently sacrificed “mom time” so I could complete this process.

## ACKNOWLEDGMENTS

I would like to thank first and foremost my three daughters for taking on the challenge of becoming more self-sufficient every day so I could complete this degree. I would also like to thank my mom and all my siblings for getting me through hard times. On a professional level, I want to acknowledge The TCT Teachers, the District and School Leadership, and the Technology Mentor Teacher for their help and willingness to trust me and work collaboratively on this project. Finally, I want to thank Dr. Puckett, Dr. Foulger, and Dr. Bengochea for all their mentoring and support.

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## **Chapter One: Introduction**

Technology has allowed for the creation of learning environments that support anytime, anywhere access via web-based resources. It has also lessened the focus on directed instruction and created a greater emphasis on collaborative learning. Research has demonstrated that in spite of having technology at their disposal, teachers are not using it to its full potential (Gorder, 2008; Levin & Wadmany, 2008; Zhao & Bryant, 2007). In school districts, like the one used for this research project, it is not uncommon to participate in only a few hours a year of professional development are related to technology integration. This is in spite of the fact that outfitting schools with technology is an expensive venture. This lack of professional development is generally due to the fact that schools are constantly managing many different critical initiatives and mandates. Since teachers are occupied with students most of the day, time for ongoing professional development is extremely limited even with creative scheduling.

This research attempts to address some of the challenges surrounding professional development and technology integration. The intervention that was carried out consisted of a community of learners focused on technology and learning. The idea was to develop a small community of teachers to build local capacity at each school for technology integration. Ideally, they would become local experts for technology and teaching, and they would be willing and qualified to share their knowledge with others. Since the teachers face time constraints and are at a geographical distance from each other, there was a further need to use online tools to increase the learning opportunities. The intent was to create

synergy among the community to create a self sustaining model for change and increase tech integration for all classrooms across the district.

### **Context of the Innovation**

This research takes place in an inner city school district in Phoenix, Arizona consisting of one grade 7-8 school and four K-6 schools. The district has a free and reduced lunch rate of approximately 90%. This high poverty rate has meant that the district has been able to benefit from federal funding, providing the opportunity for school sites to purchase up-to-date technology. Each of the schools have a full-time technology teacher and computer lab. Additionally, each campus has one to three additional computer labs and/or mobile laptop labs for teachers to use as needed. The junior high school has a school-wide 1:1 netbook implementation. Throughout the district, all teachers have a desktop or laptop computer; 80% have a projector; and 65% have an interactive white board. The district has student-to-computer ratio of 3:1. The concentration of technology per building is not consistent or standardized as each school is afforded the opportunity to determine spending priorities. This means that in some buildings, the administrator may choose to dedicate a large amount of money yearly to technology purchases where at another district school, the infusion of technology occurs at a slower rate.

In spite of the infusion of technology in the schools, technology literacy levels of students are low. Twenty percent of fifth and eighth grade students are given a Technology Literacy Assessment yearly as required by the Arizona Department of Education. The assessment addresses student skills in the

following areas: systems and fundamentals, social and ethical, word processing, spreadsheets, multimedia and presentations, telecommunications and internet, and database. The assessment is performance based. It uses a simulator and asks the students to perform specific tasks related to each area. The data from the 2009-10 school year demonstrated that only 32% of the fifth grade students met the proficiency standard and 56% of eighth graders met the standard across all the areas.

The Technology Department in the district consists of a Technology Director (this researcher), two District Level Technicians, a Network Engineer, and a Technology Mentor Teacher. Each school site also has a Technology Teacher who teaches technology to students and is also responsible for providing minor technical support to campus computers.

The district has one Technology Mentor Teacher who works with each school principal and coordinates training on an as-needed basis at each campus. Due to the job demands of this position, it is nearly impossible for her to follow up with teachers after training sessions are delivered. In addition to group training, she also works with teachers by request to assist them in integrating technology into instruction. When teachers take advantage of her expertise, the amount of one-on-one time she can spend is limited as she is also enlisted for a multitude of other technology projects not related to instruction at all. As a result, there is a need for more site-based expertise for educational technology.

The Technology Director (this researcher and study author) is responsible for the oversight of the technology plan, infrastructure, technical support staff,

technology instructional support staff, technology grants administration, and overall district systems support. Currently, a district plan has not been executed specifically for professional development opportunities in educational technology.

The district has adopted a Professional Learning Community (PLC) model as the basis for professional development. Typically these PLC groups are school based. However, one Wednesday a month is designated as district PLC time. This is where specific district departments or cross-campus groups of teachers have two to three hours of dedicated time to work together. This intervention is aligned with the District's PLC initiative and the Technology Core Teacher PLC (TCT) is recognized as a district-level learning community.

### **Intervention**

The concept of the TCT community was based on the need to improve technology literacy levels of students and to increase student engagement through the integration of technology into the curriculum. The purpose of this group is to build local capacity among teachers at the school level for technology integration by providing focused training, both face-to-face and online, and support for technology integration. The intent is to provide this core group of teachers with high quality professional development in technology integration utilizing a theoretical framework of social learning.

The TCT group began as a pilot project. Phase one began in January, 2010, as part of the American Recovery and Reinvestment (ARRA) grant. This grant provided two years of funding as part of the District's Title money allocation. The funding was utilized to purchase specific hardware for the

participants to ensure they all had access to a common set of technology tools, and to pay the participants a yearly stipend of \$1,500 to attend trainings, collaborate, and work with other teachers on the individual sites. To recruit participating teachers, a job description was developed and given to the School Administrators. The funding allowed for a maximum of two teacher participants per campus. School Administrators were asked to share the opportunity with their teaching staff; interested candidates needed approval by their School Administrator. Upon approval, they were asked to submit a letter to Technology Director indicating their level of interest in technology integration and how/if they had used technology as part of their lessons in the past. The school administrator approval was indicated by a signature on the actual letter or a separate email to the Technology Director indicating as such. In this initial round of recruitment, teachers were not required to have any minimal level of technology skill. The only requirement for them, with respect to technology, was to have a strong interest in technology-based instruction and a willingness to attempt to integrate technology into their practice. Each applicant had to be a regular classroom teacher as opposed to a certified teacher working in the capacity of a counselor, reading specialist, or other non-classroom position. Principals were provided with the job description and written instructions outlining the process for teachers to make application, and were charged with communicating the opportunity to the teachers. Specific direction was not given to them as to a process for informing their staff; principals followed established District guidelines for posting and advertising positions. Exactly two teachers from each school applied with the

exception of one, where only one teacher applied. Due to the candidate pool being almost exactly the number of positions the grant funded, the applicants did not go through any type of interview process and all applicants were invited to participate.

Phase one had nine participants and ran from January, 2010 – June, 2010, representing the pilot phase of this project. Phase two, August 2010 – December 2010, represents the cycle of action research currently under investigation.

During the summer vacation, between phase one and phase two, two of the original members left the TCT group due to attrition. Teachers that left the TCT group were replaced using the same selection process as the first round. If a greater number of applicants were to apply for any one open position, there was a process in place to utilize interview questions approved by the administration, as well as a scoring rubric (See Appendix C). One school that had one opening did have three applicants apply. All applicants were interviewed by the Technology Director and the Technology Mentor Teacher. All of the applicants did in fact qualify for the position in that they demonstrated a high interest in technology integration, and all shared examples of regular use of technology with their students. They also met the criteria of a regular classroom teacher and had the approval of their administrator to apply to participate in the group. All of their scores on the rubric were comparable and their final scores were within one to two points of each other. Upon notifying the principal of the chosen candidates, she made the decision to fund two positions out of the school budget in addition



to the two positions funded by the grant. As a result, instead of the ten planned positions, round two had twelve TCT participants.

TCT teachers interacted regularly in person as well as via district approved online collaboration tools. There were three types of interactions for the teachers. The main collaboration tool was a Google Site. 'Google Sites' is a portal that provides a simple interface for anyone to create a collaborative web site. It has simple tools such as rich text editors to make adding and formatting text a simple task. It also has a library of templates to create certain types of pages (i.e. forums, links, contacts, etc.). The TCT Site included a forum page, an area for file uploads, a calendar, and a page designed to collect links to other educational technology resources. The site was accessible to teachers 24/7 via any computer with Internet access. The TCT Site was viewable by the public, but only the TCT Teachers, the Technology Mentor Teacher, and Technology Director were set up with edit access. The second type of interaction was face-to-face meetings, which took place monthly after school from 3:30-5:30 with the exception of November. Virtual meetings, the third type of interaction, occurred monthly as well at a designated time all TCT members agreed upon, with the exception of November and December. The virtual meetings depended on Elluminate™ software. This is a web based, collaborative meeting tool that allows voice, video, chat, screen sharing, a virtual whiteboard, file sharing, application sharing, and other collaborative components for up to 25 participants to work together from remote locations.

**Researcher's role.** The researcher served as the Technology Director for the district. Her role, and that of the the Technology Mentor Teacher, was three-fold as observer, facilitator, and participant. The Technology Director and the Technology Mentor Teacher are referred to as the Technology Leadership Team (TLT) for this project. The Technology Director supervised the Technology Mentor Teacher and worked collaboratively with her to plan the teacher meetings, deliver training, plan training topics, and manage the funding for the teacher stipends and hardware purchases. They met regularly to plan, reflect, and ensure goals and objectives of the TCT group were met. This included standardizing on practices for how to create independence within the community. The intent was to build community by providing a structure around meetings and coordinate organizational support for collaboration time while allowing community members to have input into the training topics and encouraging relationships so members would become more dependent on each other. This was done by encouraging community members to share their own areas of expertise, providing time for collaboration and social learning as opposed to delivering knowledge, encouraging reflection and dialogue both in person and virtually, encouraging dialogue and problem solving outside of meeting times, and providing and creating opportunities to institutionalize the TCT group at a district level.

**Phase one – The background for the current research cycle.** The first face-to-face and online, synchronous meeting of the TCT group during phase one was designated to becoming familiar with the online collaboration tools, discussing group norms and expectations, and practicing with the online tools.

The Google Site was intended to evolve around the needs of the TCT group. All participants and facilitators of the TCT group had full access to the TCT Google site. With this access, they could all redesign the physical appearance of the site, add different types of pages such as forums, information pages, and areas to upload files. They could also add content and resources such as ideas, plans, technology tools, and links. The intent was that the site would change according to the group's needs.

At the first physical meeting, TCT teachers were trained by the TLT on how to log in to the Google Site, how to create a discussion thread, how to respond to a discussion thread, and the basic functionality regarding how to change the site design by adding pages or other elements such as links or graphics. It was emphasized to all TCT teachers that the site was meant to be functional for the group and that anyone should feel free to add content, alter the site design, introduce new topics, and respond to topics as they saw fit. As an initial step to avoid fading participation, all TCT teachers were required to subscribe to Google site changes. This ensured that every time any change was made to the site, all TCT teachers received an email with a notification and link to the changed element. During this initial meeting, TCT teachers were also taught how to access the Elluminate™ meeting tool, the synchronous communication tool that would be used for online meetings. Time was provided to ensure all teachers could connect and acquire basic familiarity with the interface, including chat, microphone, webcam use, and other basic features such as application sharing. To follow up, the next group meeting was in a virtual format. The entire

purpose of this meeting was for the TCT teachers to log in from remote locations and experiment with different aspects of the tool during a designated time so that everyone could become accustomed to interacting in this synchronous, virtual format from separate locations. The idea was to allow for difficulties and technical issues and work together to try and solve these problems before the first content focused online meeting.

At the beginning of phase one, all the TCT teachers demonstrated different skill levels and discussed their individual experiences with using technology in the classroom. Because the grant was written to fund specific hardware devices with an emphasis on multimedia, this researcher chose podcasting/vodcasting and Google Applications as the initial training topics to ensure a basic level of competency for the TCT teachers. These particular tools were selected because of their open-ended nature in that they could be used in all classrooms, independent of grade level or classroom configuration.

The physical meeting formats were designed in a 50% train/50% collaborate model. The actual skill training was designed to take up about one half of the physical meeting time. The second half of the time was allocated for teachers to practice their new learning and collaborate with peers to determine how the new technology could be used with students. At the end of each meeting, the teachers were asked to discuss how the technology they learned in the training could be used for their particular grade level. They were then invited to interact via an online forum page that was part of the Google Site. This was consistent

with the theoretical framework of social constructivism and provided opportunities for socialization.

The TLT's role was that of group coordinators for the meetings. Their role was not to solve all the problems, but to facilitate a forum for discussion so TCT teachers would begin to depend on each other. During these collaboration times, they redirected questions to the group to encourage mutual problem solving and trust among the group members.

After each physical meeting, the expectation was that the TCT teachers would apply their new learning at some point before the next scheduled virtual meeting. This pattern of learning a new skill, posting about their new learning, applying the skill, and then discussing the experience during the virtual meeting was established by this researcher and the Technology Mentor Teacher. The intent was to impose a structure that would reinforce the learning, provoke idea generation, and create a sense of support and dependence among the TCT Teachers. All the technology learning presented to the TCT teachers was chosen based on its flexibility to be applied across multiple grade-levels and subjects. However, if teachers felt they were not in a place with respect to their content to where they could foresee an effective use of the technology they had access to, they were told they should experiment themselves more with the tool, talk with others, and come back at least with an informal plan as to how they may integrate the technology more specifically in a particular lesson in the future. Teachers were getting a stipend for their participation and were made aware of these expectations. There were a few rare occasions where a particular teacher may not

have had anything to share. However, the majority of the time, they were eager to discuss ideas.

There were four face-to-face meetings. Approximately two to three weeks after each, the group participated in a virtual meeting using Elluminate™ software. For the virtual meetings the agenda was focused around the TCT Teacher's application of their learning from the previous physical meeting. The meeting was meant to be a debrief on the learning with technology experience they designed for their students, as well as a reflective time to allow the teachers to collaborate, share ideas, and problem solve together about how the technology tool was integrated with teaching particular content and how the technology component may have affected the actual delivery of the lesson and/or the student learning. This researcher was the moderator for the virtual meeting in that she managed the tools in the Elluminate portal, to assist with technical issues and create a virtual space for the meeting to occur. All TCT Members could share their screens, talk, or chat as needed. The TLT did ask questions to prompt discussion and encouraged follow up questions. The meetings were meant to be free flowing conversations. However, because not all the participants used webcams, trying to gauge the timing during natural conversations was cumbersome. This resulted in the meetings displaying less natural conversation and ended up being more turn taking.

The meetings were structured during the first half when the Technology Mentor Teacher or this researcher presented the technology lessons or dealt with business aspects of the group. However, after the initial presentation they were

not highly structured. Teachers were encouraged to discuss ideas with each other and experiment with the new learning. In some cases they were asked to create samples of how they might teach a particular concept using the technology. Consistent with social constructivism and the notion of CoP, opportunities for group members were provided to discuss and serve as leaders and experts.

In between meeting times and formal use of the forum page within the Google TCT site, teachers were encouraged to use the Google site to share ideas, post resources, post issues, problem solve, or simply communicate with the whole group. To create opportunities and encourage discussion, the TLT posted questions, issues, and resources to encourage the teachers to become accustomed to utilizing the site. The teachers were not asked to post in all cases, but the intent was to create posting opportunities that were important and relevant enough to encourage discussion or sharing in a natural way, and to lessen fading participation.

At the end of this first research cycle, records of participation indicate that the TCT group passed stage one, 'potential,' within the stages of development of a CoP, demonstrating signs of progressing towards stage two, coalescing (Wenger, McDermott, & Snyder, 2002). Coalescing was demonstrated by signs of trust between TCT teachers, TCT teachers seeking out each other for help, having honest discussions, and interacting with each other outside of meeting times.

**Phase two – The current research cycle.** Phase two of this research project followed the same basic meeting patterns as phase one. The dynamic

changed slightly, however, in order to strengthen the group’s progression through stage two, coalescing, and toward phase three, maturing, within the stages of CoP development (Wenger et al., 2002). The Project Timeline is in Table 1.

Table 1

*Project Timeline*

Dates	Tasks
July – August 2010	Participants chosen and consent forms signed
August 2010	ISTE NETS-T pre-self assessment administered
August 2010 – December 2010	Monthly meetings and online collaboration of TCT Group occurs
November 2010	Complete interviews and begin to analyze online portal data
December 2010	ISTE NETS-T post-self assessment administered

The technology tools presented during the physical meeting times were chosen based on the hardware and software that was widely available on all the campuses and computers across the district. Another important consideration was how flexible the technology tool or concept could be across grade levels and content areas. As a final consideration, all the technology tools also had to be accessible for teacher or student use. For example, a lesson may be developed where the teacher uses the technology exclusively. However, students of all levels should be able to interact with it as well. The main technology topics explored are listed in Table 2.



Table 2

*Meeting Schedule and Main Topics for Phase Two*

Date	Topic	Main Facilitator
9/15/10	Business Meeting and minor content – Get to know each other, Scheduling, Using Elluminate™, Accessing Google Site and Tools. Intro to Audacity and Podcasting.	Technology Mentor Teacher and Technology Director
9/20/10	Virtual Meeting – Multiplication Poetry – How to use Audacity to create podcasts to help students learn multiplication facts.	A TCT Teacher
10/20/10	Introduction to Twitter and Glogster. Planning time for District-Wide PLC Educational Technology Learning Day	Technology Mentor Teacher and Technology Director
10/25/10	Virtual Meeting - How to Use Power Point to Organize Your Day	A TCT Teacher
12/1/10	Podcasting Review – Using the iPods Posting Mp3 Files to the WWW	Technology Mentor Teacher and Technology Director
1/19/11	How to Use Prezi How to embed on the WWW	Technology Mentor Teacher and Technology Director

The technologies that were emphasized for classroom use were: Podcasting, Glogster, Using PowerPoint to Organize your Day, Audacity, Podcasting and Prezi. Some of the tools such as the Google Site, Elluminate, and Twitter were presented as collaborative options and ways for teachers to build and interact with other members of their professional learning network. Although these tools are

also valued for their classroom potential, limitations within the district meant they did not meet the selection criteria, e.g., Twitter was blocked for students, only 3<sup>rd</sup>-8<sup>th</sup> grade students had logins to the Google Applications for Education, and the district only owned 25 Elluminate™ licenses.

The Technology Director and the Technology Mentor Teacher continued in their role as community coordinators. These roles altered slightly from planning all the topics and structure of the meetings to encouraging the individuals in the group to choose and present topics during the virtual meeting times. The intent was to allow group experts to emerge among the membership and provide encouragement for others to create discussion topics and/or share technology resources and ideas. This also involved encouraging the TCT teachers to build a professional learning network beyond the district community utilizing social networking opportunities. These actions were at the discretion of the TCT teachers but were encouraged by the community coordinators as part of their networking role. Efforts by the community coordinators included the institutionalization of the TCT teachers across the district. This was done by coordinating an effort with school and district administrators to host two district-wide technology integration PLC days. This included taking advantage of the TCT teachers' expertise to help coordinate and teach other teachers from across the district. School administrators were also encouraged to use the TCT teachers from their individual sites to deliver training on their own campuses as well as to model educational technology and to mentor other teachers.

**Purpose of the study.** The purpose of this study is to determine the professional development benefits of developing a TCT group in this manner. Specifically, in what ways would such a collaborative group influence teaching practices and effect teachers' technology skills? If school district technology professional development were structured, with a combination of online and face-to-face meetings, what factors support or inhibit interactions among the participants? And finally, what are indicators that group collaboration around classroom technology integration is likely to continue once district involvement ends?

## **Chapter Two: Literature Review**

Educational technology has been both celebrated and criticized in recent years as school district budgets have allocated large amounts of money toward supporting technology initiatives (Aviram & Talmi, 2004; Barron, Kemker, Harmes, & Kalaydijan, 2003; Baylor & Ritchie, 2002; Sancho, 2004;). Within the realm of educational technology is the issue of professional development for teachers. Research indicates that traditional professional development programs focused only on technology skills and learning have not had a transformational impact overall (Gorder, 2008; Zhao & Bryant, 2007). This literature review begins by introducing technology integration and professional development from the perspective of traditional implementations and through a discussion of professional learning communities (PLC) and communities of practice (CoP). Then, social constructivism is discussed as a theoretical framework for this research. Finally online collaboration and learning is presented as part of the community-based, social learning paradigm for classroom teachers.

### **Technology Integration and Professional Development**

In 2000, the International Society for Technology in Education (ISTE) released the National Educational Technology Standards for Teachers. These standards were updated in 2008 to address 21<sup>st</sup> Century teaching and learning concepts. The current standards are meant to provide a framework for teachers to move toward teaching in the digital age (International Society for Technology in Education, 2008). This framework provides significant guidance for schools that debate the investment of technology. Despite these national efforts, it is not clear

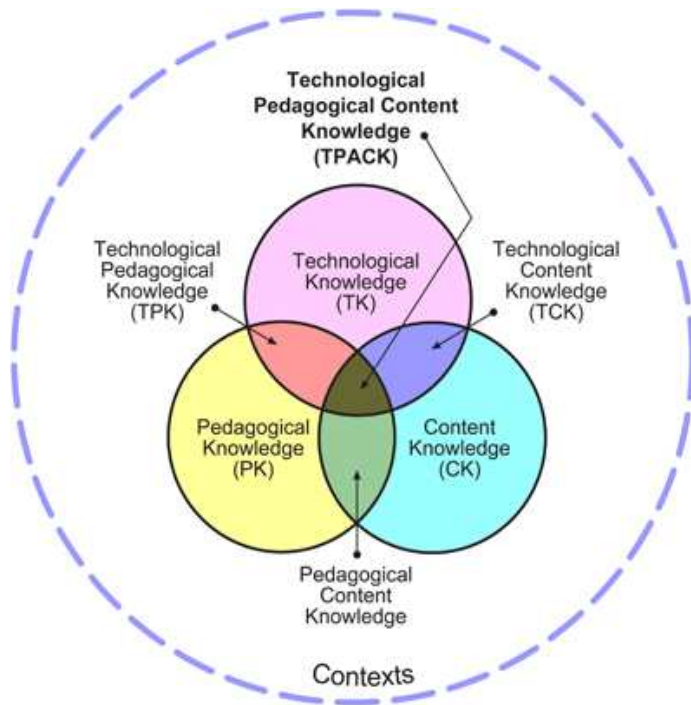
if educational technology makes a positive impact on student learning (Sancho, 2004). Moreover, the full potential of the influence of technology will not be known without facing fundamental changes with respect to the mental models of teachers and students, the overall organizational culture, and the model for educational funding. Chandra and Lloyd (2008) also demonstrate conflicting results with regard to technology and student achievement. They indicate technology in learning can be equally harmful or beneficial, and that the outcome depends on a multitude of interrelated factors. Technology use is further challenged by research that indicates teachers who have access to technology are not using it to its full potential. Technology integration into the curriculum is minimal, with the main use of technology in the classroom being for administrative purposes (Barron et al., 2003; Gorder, 2008; Hart, Allensworth, Lauen, & Gladden, 2002; Zhao & Bryant, 2007). Levin and Wadmany (2008) agree that there is large discrepancy between the promises of technology and the reality of how it is used in schools. There is a trajectory of studies that demonstrate similar results over the last decade. As far back as 2000, an extensive study was conducted by the Consortium on Chicago School research (Hart et al., 2002). The study included 11,214 teachers representing both elementary and high school. The results demonstrated only 24% of the teachers self reported they were 'modestly integrating,' 31% reported 'limited integration' and 29% indicated 'no integration' (Hart et al., 2002). Similar results were found in a study of 2,156 teachers from one of the largest school districts in the country. In spite of district offerings of regular professional development classes focused on integration, only

twenty percent of teachers self reported using technology as a problem-solving tool at the high school level and 59% indicated they use technology as a communication tool at the elementary level (Barron et al., 2003). In a survey commissioned in 2005, results demonstrated 80% of K-12 teachers use technology mainly for administrative purposes and only slightly more than half actually integrate technology into their instruction (Zhao & Bryant, 2007). Gorder (2008) found similar results in her research of 174 K-12 teachers. Her findings indicated teachers tend to use technology effectively for their own productivity, but do not integrate technology as well into teaching and learning. Even in schools with abundant technology, teachers tend to use technology most frequently for management and administrative purposes. Use of technology to facilitate integrative student centered pedagogy is rare (Palak & Walls, 2009).

One of the recommendations to address teacher challenges with technology is professional development that goes beyond simply teaching technology skills. Where this may help teachers attain a basic level of use, teachers need to participate in curriculum-based training that helps them integrate technology into their existing curriculum (Baylor & Ritchie, 2002; Reynolds & Morgan, 2001; Zhao & Bryant, 2007). Standard professional development programs involving isolated training opportunities with little to no follow up have often been shown to be disconnected from the teaching practice, disjointed, and not aligned (Schlager & Fusco, 2003). This is often due to a lack of resources and/or ability to address the needs of teachers at divergent stages of expertise (Schlager & Fusco, 2003).

There is also generally a shortage of resources in the form of mentors or other local expertise to provide ongoing support (Schlager & Fusco, 2003). Moreover, professional development in technology appears to have a “short impact shelf life.” Although training in general improves teachers’ attitudes and confidence, mentoring and follow up training are necessary for teachers to use technology to enhance student learning more effectively. Teachers that do not receive any follow up report a loss of skills and reluctance to use technology with their students (Zhao & Bryant, 2007). The need to apply knowledge to a practice that is ever-changing promotes a more participatory process of doing and belonging as opposed to receiving information. This need supports a community based model of professional development (Bielaczyc & Collins, 1999; Schlager & Fusco, 2003).

**The TPACK Framework.** In an attempt to better understand the knowledge required by teachers for effective technology integration, the Technological Pedagogical Content Knowledge (TPACK) framework strives to emphasize the connections between technology, curriculum content, and pedagogical approaches. It is a representation of professional knowledge that teachers who are adept at technology, pedagogy, and curriculum make use of when they teach. As illustrated in Figure 1, the framework breaks down the concept of technology integration and recognizes the multitude of interactions that exist among content, pedagogy, and technology, indicating professional development that only teaches technology skills is insufficient.



*Figure 1*

Technological Pedagogical Content Knowledge (TPACK) Model  
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Technology skill training alone leaves teachers without the knowledge of how to use technology to teach more effectively, neglects the relationship between technology and content knowledge, and does not address how to teach curriculum content standards to students while using technology appropriately in their learning (Harris, Mishra, & Koehler, 2009).

Integrating technology into instruction is not as simple as adding a new tool to an old practice. Teaching as a practice is constantly evolving, and the technology component provides an infinite number of resources and potential.



Within this realm is the need for content knowledge on the part of the teacher. So, there is not a “one size fits all” model to teaching teachers how to integrate technology into instruction. To address these layers and the complexities involved around technology and teaching and learning, the TPACK framework breaks down the concept of technology integration into seven components.

1. Technology Knowledge (TK): The knowledge about different technology from low-level technology like pencil and paper to digital technologies such as interactive whiteboards and computer based technologies.
2. Content Knowledge (CK): This refers to knowledge about the actual subject matter being taught.
3. Pedagogical Knowledge (PK): The methods and processes behind teaching, inclusive of aspects such as classroom management, assessment, learning, lesson plan development, and the like.
4. Pedagogical Content Knowledge (PCK): This is the content knowledge as it relates to the teaching process and the end goal of developing better practices within different content areas.
5. Technological Content Knowledge (TCK): An understanding the way technology can create different representations of content and how it can change the way students understand concepts within the content.
6. Technological Pedagogical Knowledge (TPK): This is the knowledge about how different technologies may be used in teaching and how using that technology may change teaching.

7. Technological Pedagogical Content Knowledge (TPACK): This is the knowledge teachers must have to integrate technology into the teaching of different content areas. (Schmidt, Baran, Thompson, Mishra, Koehler, & Shin, 2009)

Where TPACK is not a professional development model, the ideas behind the framework serve to provide guidance for professional development programs in that it emphasizes what teachers need to know about technology, pedagogy, content and the interrelationships to use technology effectively for teaching and learning (Harris et al., 2009).

### **From Professional Learning Community to a Community of Practice**

**Professional learning community.** According to Stoll and Louis (2007), the professional learning community (PLC) concept suggests the idea of professional learning focused on collective knowledge among a cohesive group in a culture of interpersonal caring that permeates the life of those involved in the school community. A PLC is a model that emphasizes shared leadership between teachers and administrators, collective learning among all staff, the application of new learning to address student needs, feedback and support by peers, and a culture of collaboration (Hord, 2009). PLCs have a focus on a shared purpose and emphasize a constructivist learning approach. As a result, authentic activities occur in a social context and learning is controlled internally and mediated by the learners. Within the scope of education, it is recommended teachers are provided designated meeting times for smaller groups such as grade level/content teams. The focus of this designated meeting time is meant to be on

curriculum/instructional practices, supported by data, and with emphasis on student achievement. In addition, regular time should be provided for large schoolwide meeting time as well (Hord, 2009).

**Communities of practice.** Similar to PLCs, CoPs involve groups of people working together around a common theme. They are defined by Wenger (2004) as “groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly (p. 1).” The concept of CoP, according to Wenger (2004), exists in almost all social contexts. CoPs involve the construction of new knowledge through social interaction. They have problem solving characteristics and they seek experience among other group members.

Juwah (2006) associates the notion of a CoP to the concept of peer learning, which involves learners that are actively engaged in multifarious intellectual, social, and emotional interactions that lead to knowledge construction, the development of new skills, and the creation of new meanings. In a CoP, members make requests of information from each other and demonstrate coordination and synergy when making decisions. They work together to be efficient by reusing information and assets and documenting activities as well as reconciling advancements and gaps. In addition they seek each other for continued interaction.

Membership dynamics are significant within a CoP. There are issues of membership, identity, socialization, and overall need for mutual engagement among all members (Wenger, 1998). According to Wenger (1998), mutual

engagement is defined as belonging to a community just as the idea of inclusion into the group is a requirement for being engaged. In other words the act of being included in doing something that matters is all that is needed to hold the group together.

Another important aspect to belonging to a CoP is identity. Identity is what allows the individual to identify with the community either through participation or non-participation (Wenger, 1998). Wenger (1998) explains that identity is a dynamic process and that while engaging, participation in a community may be very positive or may create relations of marginality. Juwah (2006) acknowledges this reality and proposes that for peer learning groups to perform and connect effectively, they must be socialized. This implies managing the group size, ensuring the context is well understood by the participants, establishing norms around communication of all types, and having a sense of cognitive presence (Jawah, 2006). Cognitive presence is defined as “the extent to which participants in a community of learning engage in sustained dialogue and discourse, and through this engagement are able to negotiate and construct meaning” (Jawah, 2006 p. 175). It is important to consider mutual engagement, identity, socialization, and cognitive presence within a CoP as the culture, socialization, and rapport of the group will all be significant for learning and knowledge sharing.

**Professional learning community versus community of practice.** The concepts of PLC and CoP are similar in that social learning is the emphasis. However, within the structure of a PLC, the prevailing notion is surrounded by

the concept of creating a professional culture within schools where ongoing, focused collaboration is expected and exists with a common focus on improving student achievement (Seashore, Anderson, & Riedel, 2003). It is a social learning structure that has is formal, has a specific purpose, and is goal-oriented. In the case of a CoP, however, naturalness with respect to participation is a hallmark. This implies the CoP is not artificially created and the ebb and flow of the group is controlled by the members' participation (Klein and Connell, 2008). This means group members continue to share and grow beyond professional focus, expectation, and obligation. Learning evolves into a voluntary and dynamic process involving self disclosure, reflection, and growth (Yildirim, 2008).

Research in the areas of PLCs and CoPs are abundant. There is a paucity of studies, however, that specifically address the topic of moving practitioners that are members of a PLC to a CoP. Therefore, it is necessary to look at the stages of development of a CoP so as to be able to identify what a progression to a CoP might look like. Research suggests here are five stages of development for a community of practice: potential, coalescing, maturing, stewardship, and transformation (Wenger, McDermott, & Snyder, 2002).

***Stage 1: Potential.*** Potential is the earliest stage where community members discover other people have similar problems and passions around the same topic. The key issue is to identify common knowledge needs and to allow the community to develop instead of trying to define all goals and outputs at the beginning. For this stage a good community coordinator is necessary. However, it is important to remember that a community coordinator is not meant to be the

leading expert of content but rather the leader who links people and builds community as opposed to giving answers or directives. The community coordinator must be able to build bridges through the exchange of information between the formal organization and the community as well as between the community members themselves (Wenger et al., 2002).

***Stage 2: Coalescing.*** Stage two is coalescing. During this stage the community is focused on activities that allow members to build trust and relationships, and establish awareness of common interests and needs. It is critical that during this stage community members find value in participating and are able to have honest discussions. Trust is also critical during this stage so that community members begin to seek each other out for help. It is only through these types of experiences that relationships will deepen and a collective mentality around problem solving will develop. During this stage the community coordinator(s) must take the necessary time to establish this strong foundation. It is also important to not only focus on the formal meetings of the community; rather, it is necessary to work in private space as well connecting individuals and learning about current issues. Coordinators in this stage must be able to network and seek out community members in order to socialize about common issues. Finally, the coordinator must feel competent technically among group members so as to be able to relate to the group and move the group forward (Wenger et al., 2002).

***Stage 3: Maturing.*** Maturing is the third stage. This is the stage where the shared knowledge within the community may expand into a new domain or

where the core members begin to feel there are gaps in the community's knowledge. Physical membership may also expand or change causing stress on the existing relationships. At this stage it may be necessary to redefine the scope of the community and create processes for the entry of newcomers. It may also be necessary to create new processes for documenting the activities and knowledge of the community (Wenger et al., 2002).

***Stage 4: Stewardship.*** The fourth stage is stewardship. During this stage, the energy around the community can decline. It is difficult to keep the tone engaging and exciting. The key issue is to maintain the community on the cutting edge so that passion around continued growth and knowledge can be maintained. During this stage it is important that the community coordinator works to expand the focus and ideas. One way to do this is to institutionalize the voice of the community and ensure the community's work is filtered throughout the organization. Rejuvenation by organizing joint meetings with other communities, introducing new members, or introducing new topics are ways a community coordinator can inject energy. Another option is to rotate leadership and allow different community members to take on the role of community coordinator (Wenger et al., 2002).

***Stage 5: Transformation.*** The final stage is transformation. As new ideas are injected during the stewardship phase, tension may exist between a community's sense of self and the expansion towards new learning. Some members may feel less ownership and less connected. When this happens on a larger scale, it may lead to a return to an earlier stage of community development,

or it may be the causation for the community to end altogether. This transformation can also lead to mergers with other communities or the institutionalization of a community into an actual professional work department (Wenger et al., 2002).

### **Social Constructivism**

This idea of group interdependence for learning and collaboration and using technology to create the collaborative workspace for a CoP to develop and engage its members is based on social constructivism learning theory. Social constructivism is represented by the idea that knowledge is generated through social exchanges and that through these exchanges one gradually accumulates advances in knowing (Kanuka & Anderson, 1998).

Social constructivism was greatly influenced by Vygotsky in the 1930s. He was interested in the role of the learners as they conversed and interacted to negotiate meaning (Woo & Reeves, 2007). Wertsch (1991) analyzed the writings of Vygotsky and proposes his work embodies three major themes. The first indicates that the development of the individual, inclusive of higher mental functioning, has its roots in social sources. As learners participate in activities with others, they develop new strategies and knowledge of the world and the culture. Within this framework, learning involves social interdependence found in collaboration, group activities, and teamwork to solve real world problems. There is an expectation that learners will bring their own life experience and previous knowledge to learning situations (Johnson, 2001). This social learning theory serves as the rationale for utilizing CoPs to grow learning potential through



establishing relationships. Following the ideas of Wenger (2004), it is the social context of like-minded individuals that allows for learning to occur naturally. Significant learning takes place among communities that are loosely structured, have similar experiences and the opportunity to have informal social interaction within the formal activities of, for example, professional associations (Benner, 2003).

The second major theme Wertsch (1991) asserts from his analysis of Vygotsky's writings is that human action, in the individual and social contexts, is facilitated by signs, symbols, maps, language, and tools. This is referred to as semiotics. Semiotics facilitate the construction of knowledge and internalization of information that can be used for problem solving. Within a CoP, semiotics are significant as learning is done through talking and collaborating as opposed to teacher-centered modeling.

The third theme proposed by Wertsch (1991) is that the first two themes are best examined through genetic or developmental analysis. According to Palincsar (1998), this implies all learning and development occur in the context of social and cultural planes-- an ever-shifting and changing context. There is no way to universally or absolutely define the dynamic nature of the internal and external aspects of development. So, learning cannot be predicted and prescribed by regimented methods.

### **Online Collaboration and Learning**

Online communities are similar to communities that meet face to face in that learning occurs naturally in the context of social collaboration; the difference

is the communication method. Wenger (2004) acknowledges spoken interaction is very distinct from online interaction. This factor has generated a great deal of discussion around the concept of a CoP within a virtual environment.

**Socialization.** Schweier (2002) indicates a virtual learning environment is present when learning takes place outside of the typical boundaries of face-to-face interaction, typically online via the World Wide Web. For an online community to form, however, participants must be able to engage with intention and in a collective manner. Juwah (2006) refers to this as socialization. This involves creating awareness among learners surrounding diversity, creating norms for behavior and interactions, and providing a supportive online environment (Juwah, 2006). Sims and Hedberg (2006) express this same idea regarding socialization within the concept of personal narrative encounters. This refers to encounters that demonstrate empathy and tolerance allowing opportunities for negotiation and personalization. However, computer supported collaborative learning environments often lack the social interaction necessary for collaborative learning to occur. Group mediators and instructors tend to focus on the content and processes, wrongly assuming that because there is a mechanism for communication, that socializing will occur naturally (Kreijns, Kirschner, & Jochems, 2003). Humans are primarily social beings. While they seek information, they also have a need for affirmation, support, and a sense of affiliation that is not often present in online environments (Kreijns et al., 2003).

Barab, MaKinster, Moore, Cunningham and The ILF Design Team (2001) support the importance of socialization and learning in their research. They found

online learning to be deeply engaging when students are willing to be vulnerable and when they feel a sense of camaraderie with their online classmates. Computer based asynchronous tools can affect learning in a profound way by promoting reflective and critical thinking through writing and revising work in ways that are not possible within the context of normal face-to-face interaction. However, they acknowledge that in their study, they made a deliberate effort to foster deep social connections in addition to choosing a tool they felt was intuitive and simple to use.

Along these lines, case studies have demonstrated it is not enough to provide access to useful content. Consistent with the theoretical framework of social constructivism and CoPs, social interaction is a critical component for knowledge building. Benner (2003) explored how the use of an online listserv provided an effective context for individuals in common professions to learn and maintain competencies in their occupational field. This research is based on a case study of twelve leaders and members of a cross-firm learning community referred to as the Silicon Valley Webgirls. This was a group that was created for women all working in the area of Internet development and design, to interact, learn, and create critical business contacts for advanced opportunities, professional movement, and growth. The most significant aspect of the organization was the listserv for the sharing of thoughts, ideas, and information. Consistent with social constructivism, this environment allowed for professional learning through interaction with more capable peers (Huang, 2002). The postings and messages that circulated were categorized into six broad categories: general

technical questions and discussions, specific technical questions, events/resources/courses, career/business advice, jobs offered/available for work, and non-work related. The bulk of the communications were in just two categories: general technical questions/discussion and non-work related. Non-work related messages represented a critical aspect in the building of the learning community for the organization. Members felt that these social exchanges were significant in building the sense of online community. They felt it helped build trust and facilitate general communication on a range of other topics that surfaced from the other categories. These results are further supported by Kanuka and Anderson (1998), who also found exchanges that occurred in online forums fell within the category of sharing and comparing. The greatest value to the forums were those that provided the opportunity to share information and network as opposed to those designed specifically around the construction of new knowledge (Kanuka & Anderson, 1998).

**Online collaboration tools.** Choosing an appropriate model or illustration to demonstrate a concept or considering multiple methods to communicate an idea are everyday considerations for individuals who have to interact and communicate with others. When an online environment is the medium for communication and learning, the same considerations apply. There are differences however, in that because the format is distinct from typical face-to-face encounters, it is important to ensure the technology tool chosen facilitates the necessary tasks for all participants. Within the realm of online learning, Sims and Hedberg (2006) indicate that the current frameworks derived from traditional

instructor-led training used to support the design and implementation of online systems and learning tools may not be the most appropriate to understand the dynamics of a virtual, asynchronous, collaborative learning environment. Barab et al. (2001) attributed great importance to the effectiveness of the technology tool emphasizing participants did not interact with computers, rather they interacted through computers with each other. Sims and Hedberg (2006) also discuss the importance of the tool in an online environment. They frame this around their discussion of ‘directing encounters.’ Within this concept, they emphasize the need to employ a flexible online learning tool that allows all members of the online community to facilitate activities, comment to each other, and create resources and activities to ensure an individualistic and learner-centered environment (Sims & Hedberg, 2006). Kreijns et al. (2003) also affirm that the design of collaborative computer environments need to be ‘sociable,’ and provide contexts for off-task communication that facilitate impromptu encounters among members of the learning group. Finally, it is important for the development of a community of practice using virtual tools to have support in place so all members are proficient with the online tools that are used (Johnson, 2001).

**Considerations and challenges for virtual environments.** Online virtual learning environments provide many obvious advantages such as anytime, anywhere access to content as well as access to personal expertise from participants with common interests. Within these environments however, challenges can arise such as misunderstandings surrounding the style of online communications, lack of personalization, technical difficulties, and fading

participation. Hammond (1998), in his research of teachers and librarians, engaged in the exploration of professional practices in an online environment and found online discussion to be an excellent forum and engaging environment for teacher professional development. However, these online environments have to be structured in a way that timely participation can be achieved and maintained. The findings also demonstrated turn taking can be unstructured and threads can be difficult to follow. There was a sense that because typing is more labor intensive, participants limited their responses to shorter exchanges. This sometimes led to other participants getting irritated by the style or tone of some of the messages. In addition, the permanent nature of the responses intimidated some. Hammond (1998), recommends that online norms may need to be created before establishing an online meeting space, and that there needs to be an awareness of the issues around online exchanges so they may be anticipated and addressed in order to make online learning and collaboration more effective.

*Facilitating online encounters.* To facilitate some of the difficulties that can arise around communication and collaboration in a virtual environment, Sims and Hedberg (2006) discuss the concept of welcoming encounters. This refers to the practice of creating introductions between the participants and providing guidance surrounding the use of the online tool. Consistent with Hammond (1998), Sims and Hedberg (2006) also address the development of norms, expectations, and ‘netiquette’ within the concept of ethical framing encounters. Johnson (2001) supports the notion of group norms, communication conventions

or protocols, and the development of skills around synchronous and asynchronous discussion (Johnson, 2001).

*Communication difficulties.* Another issue that can arise within online learning environments is that computer mediated collaboration can sometimes be considered impersonal due to the lack of social context clues and non verbal information (Kreijns et al., 2003). Powers and Guan (2000) also indicate that virtual, web-based environments can become impersonal, particularly without frequent contact among participants. There is a sense however, that if given sufficient time, personal impressions can occur (Kreijns et al., 2003). It is noted that participants may need to be coached in online discussion so that the content does not become too superficial or lacking in quality, and that participants within the context of online classes should be required to read others' responses (Oliver & Herrington, 2000). In spite of the challenges, Johnson (2001), indicates that the lack of face-to-face contact in web-based interactions can be advantageous allowing for the suppression of traditional norms and providing opportunities for more introverted individuals to participate more freely.

*Fading participation.* Finally, another significant issue with respect to virtual communities is fading participation. To address this, it is recommended facilitators use a variety of communication technologies simultaneously to help minimize this issue. The importance of early bonding and regular online meeting times initially are also emphasized to ensure the sense of community is well established (Haythornthwaite, Kazer, & Robins, 2000).

## **Conclusion**

Teacher professional development is necessary for the successful integration of technology into the classroom. However, one time in-service sessions are not sufficient. The integration of technology is complex. The TPACK framework (Koehler & Mishra, 2009) can serve to provide an understanding of the knowledge required by teachers to effectively use technology in their instruction. Teachers also need ongoing support. The theoretical frameworks of social learning theory and CoP support these notions. Due to the geographical distance and time constraints teachers face, online collaboration can be an option that can serve provide a community with additional opportunities to collaborate and learn from each other, but factors such as the tool, socialization, communication styles, and fading participation need to be considered. Given the needs to build capacity in the district where this research is taking place, the works cited here informed the development of the TCT and guided the methodology used to study its effectiveness.



## **Chapter Three: Methods**

### **Research Questions**

Four research questions have been posed for this project:

1. In what ways did participating in the TCT project influence teaching practices?
2. What was the effect on teachers' technology skills after participating in the TCT group?
3. What factors support or inhibit online interaction of the TCT between the regular face-to-face meeting times?
4. What are the indicators that a technology-based CoP is likely to continue to develop once district involvement ends?

### **Participants**

Twelve classroom teachers were chosen for this cycle of action research to participate as part of a greater district initiative to build capacity for technology integration at the school site level. After the selection process, they were invited to participate in this research project during the first face-to face meeting in September, 2010. This researcher read them the verbal script (See Appendix A) and provided them with the consent letter (See Appendix B). The original intent of this project was to choose two teachers from each campus. However, due to additional funding circumstances one school had four teachers represented. Seven of the TCT members continued into this cycle of action research from phase one. Five of the members were new to the TCT group in phase two. The phase two participants consisted of two middle school teachers focused in the content areas

of English and Social Studies, two first grade teachers, one second grade teacher, one second and third grade combination teacher, three third grade teachers, one fourth grade teacher, and two special education teachers. The teachers' years of experience in the teaching field varied. Table 3 provides more detail regarding this.

Table 3

*Participants Years of Teaching Experience*

Years of Experience	Number of Participants
1-3	3
4-6	3
7-9	2
10-12	2
24-26	2

The participants all reported using technology at least weekly as part of their normal classroom instruction. However, the ways in which used technology was related to what they had access to on a regular basis. Based on their reports, the participants were divided into two groups, the 'green group' and 'yellow group.' These colors were chosen as a symbolic parallel to traffic lights. The 'green group' refers to teachers with high access to both student centered and teacher centered tools. Teachers in the green group have enough permanent mobile computing devices to provide at least a 4:1 mobile computing device to student ratio when needed. The mobile nature of the student computing devices is significant. This implies flexibility with regard to student movement and more up

to date devices. These teachers also have high access to other technology tools designed for demonstration and interactivity with individual students. These tools included an interactive white board, a mounted projector, digital video/still camera, an ipod, an interactive slate, and possibly a student response system. Teachers in the yellow group can use technology but may be slowed down due to the lack of devices for student use. Teachers in the yellow group typically have access to one or two student computers in their classroom and some combination of a projector, interactive white board, and/or document camera. They all have access to a computer lab, typically located in a different building, or possibly a laptop cart lab that can be scheduled and checked out. Their access to technology is further limited by lack of access to the flexibility that multiple computing devices within a wireless environment affords.

### **Data Collection**

This study was designed using mixed methods, an approach that combined quantitative and qualitative techniques. (Johnson & Onwuegbuzie, 2004). Within the mixed method paradigm, this study used an explanatory design; each data set was used to inform the results of the other. Within this framework, quantitative results were collected and the results were further explained via additional qualitative data (Gelo, Braakmann, & Benetka, 2008). Table 4 provides a brief introduction to each instrument and outlines which data source was used to address each research question. Data from the four data sets were triangulated (Oppenheim, 1992) or used in a complementary manner (Greene, Caracelli, & Graham, 1989) to assure reliability.

Table 4

*Description of Data Sources*

Quantitative Data Sources	Description	Questions Addressed
ISTE NETS-T Survey	Pre and post, to measure teachers' use of technology	2
Exit Surveys	Survey given to teachers after each TCT meeting designed to capture teachers' overall perceptions of community and level of collaboration	3 and 4
TCT Logs	A log maintained by each TCT teacher designed to record the number of hours each teacher spent on activities across four categories	1
Qualitative Data Sources	Description	Questions Addressed
Online Archives: TCT Google Site, Individual Teacher Websites, and Elluminate™ Online Meetings	The data from the TCT Google Site consisted of online forum exchanges and other written contributions to the site. The teacher website data consisted of sample student projects and lessons posted by the TCT teachers. The Elluminate™ meetings may have a chat session and/or an audio component.	1, 2, 3, and 4
Meeting Notes	Reflective and chronological notations made by this researcher during and after each meeting	1 and 4
Follow Up Survey	Survey designed to further explain findings from other data sources	1 and 2

**ISTE NETS-T survey.** Participants completed a pre and post survey based on a derivation of the ISTE NETS-T self assessment (See Appendix D).

This survey was provided to the district by an ISTE representative as a tool to

obtain baseline data for teachers participating in a specific school project unrelated to this research. It has not been normed, nor has it been promoted by ISTE as a standardized assessment tool. This survey is directly aligned with the National Technology Standards and addresses the classroom teachers' uses of technology professionally and with their students. It uses a four-point Likert scale and is divided into four constructs: Demographics, Facilitate and Inspire Student Learning and Creativity, Design and Develop Digital Age Learning Experiences and Assessments, and Model Digital Age Work and Learning. Within each construct, there are four to five survey items. The sections and basic design are all remnants of the original ISTE NETS-T instrument. This survey was given to participating teachers electronically in August, then again in December. The survey respondents were issued a number to ensure anonymity and to assure that the pre and post results could be compared.

As recommended by Cox and Cox (2008), the instrument was piloted and redacted multiple times by an existing group of teachers participating in an ISTE mentored grant project not related to this research project. The results from the pilot demonstrated teachers were responding with consistently higher scores than anticipated on all constructs. As part of the instrument revision process, the researcher discussed the instrument with three of the participants, discussing what each question meant and what the participant felt the question was asking. The participants consistently reported that the questions were sometimes confusing and addressed more than one concept in a single question. Therefore, the revision of the instrument consisted mostly of simplifying the questions by using

clarifying words and in some cases reducing the number of descriptive words. One of the changes included adding the term 'digital tools' to the questions. For example, one of the original questions read, "I can promote, support, and model creative and innovative thinking and inventiveness." This was changed based on the participant feedback to read, "I can promote, support, and model creative and innovative thinking using digital tools and resources." The instrument was tested again after the modifications using an unrelated group of five participants not associated with this research project. To check the validity of the changes with respect to the constructs being tested, a Cronbach's Alpha test was performed to ensure reliability among the items in each section.

**Exit survey.** The exit surveys consisted of five questions designed to collect attitudinal data regarding the meeting content, feeling of community, quality of collaboration, and frequency of collaboration. The exit survey questions remained consistent for each meeting. The survey was created using a Google Form and was administered electronically. The TCT teachers were provided the direct link via the electronic agenda for each meeting and were asked to complete the survey.

**TCT log.** The TCT log was a Google Spreadsheet shared with each TCT teacher. In the log, the teachers were asked to record the number of hours they spent on activities across four categories: mentoring, technical support, team teaching, and using technology in their own classroom. The spreadsheet consisted of an area to provide a description of the activity, the number of

collective hours spent, and an area to check off categories corresponded to each activity. The responses were based on the judgment of each individual teacher.

**Online collaboration tools.** As this research focuses on the use of online collaboration tools for training and collaboration, TCT members were asked to participate in two online collaboration environments throughout the course of the project. One was a Google Site designed to facilitate communication and collaboration between TCT members. Data, in the form of online exchanges, postings, resources, page edits, general content, and the access logs from the Google Site were collected throughout phase two of the research cycle.

Participants also used Elluminate™ for the synchronous online meetings. The Elluminate™ sessions were recorded and transcribed as they occurred throughout phase two of the project timeline. All data collected during these opportunities for online participation in the form of written posts, verbal posts, or audio recordings were transcribed and analyzed for content relevant to the research questions.

**Meeting notes.** Meeting notes were taken throughout phase two of the research cycle. They were taken during physical and virtual meetings using a protocol to distinguish between descriptive and reflective observations (See Appendix E). This researcher attempted to collect both descriptive and reflective data simultaneously as recommended by Gay and Airasian (2000) who indicate this allows identification of topics worthy of further observation and a more complete narrative to explain the setting that was observed. The meeting notes were significant as they provided contextual and cultural information to allow for

a better understanding of data collected via other methods (Mack, Woodsong, MacQueen, Guest, and Namey, 2005). As recommended by Mack et al. (2005) this researcher focused on data related to the research questions while still being open to relevant findings that may have emerged outside of the anticipated scope.

**Focus group.** A focus group was used to help participants explore and clarify their views and ideas through the group discussion, and to encourage participation by subjects that may have felt uncomfortable in an interview type setting (Kitzinger, 1995). The focus group was also used to address the issue of power dynamics, as the group structure has been shown to encourage open conversation and a greater sense of freedom to state criticism (Kitzinger, 1995). During the focus group session, the researcher worked as an active participant in an attempt to establish rapport, acknowledging that rapport was necessary to achieve participant disclosure, and greater disclosure would be achieved if there were a high level of rapport (Dickson-Swift, James, Kippen, & Liamputtong, 2007).

The participants took part in a 45 minute semi-structured focus group at the end of the project. The purpose of the group was to discuss their participation in the online activities, the extent to which a migration from a PLC to a CoP occurred, and their overall perception relating to how the development of the CoP influenced their classroom instruction. The focus group discussion was guided by the focus group protocol (See Appendix F). Participants were given a copy of the questions, which were meant to guide the discussion, immediately prior to the session. In some cases questions were skipped or participants were asked to



elaborate more if clarification or more detail were necessary to provide additional insight. There were not any formal methods put in place to ensure all focus group participants had equal levels of participation in the session. However, this researcher continually made eye contact with each participant and elicited more information from quieter participants by encouraging them to respond separately. In this study, because the researcher also serves as a district leader and as a member of the TCT group, there was a potential power differential between the researcher and the participants. However, as this researcher was an active participant within the TCT group, there is a sense that reliable focus group data was achieved by mediating these concerns through the rapport that was established

### **Data Analysis**

**Quantitative analysis.** For the pre and post ISTE NETS-T survey and the exit survey data, results were analyzed using Predictive Analytics Software (PASW). Results were coded and analyzed using frequency counts and percentages. Due to the pre and post nature of the ISTE NETS-T survey, a T-Test was utilized on this data set as well. The T-Test was used to compare the difference between the means of the pre and post assessments to determine whether or not the pre and post scores were statistically significant or merely a chance finding.

The TCT log data was analyzed using tally marks and frequency counts to determine the number of hours spent collectively by the group across the four main categories. Tallying was also used to count occurrences in the descriptions

where teachers were using technology tools or learning specifically addressed as part of one of the TCT meetings.

**Qualitative analysis.** The qualitative data were analyzed using a combination of grounded theory and open coding approaches. (Ryan & Bernard, 2000). Grounded theory involves the identification of categories and concepts from text that can then be linked to more substantive theories. Analysis of the qualitative data utilized the open coding process. The first step in this process is called conceptualizing. This involved reading through the data and identifying categories gleaned from the text as they related to the research project. Once the categories were determined, it was necessary to define the categories based on particular properties (Glaser & Strauss, 1967). For example ‘knowledge sharing’ was a category, but ‘on topic knowledge sharing’ and ‘off topic knowledge sharing’ further defined ‘knowledge sharing’ along the continuum of meaning for that category. Once all the data were categorized, the smaller sets were analyzed further to see if any additional sub categories applied. Finally, the frequency of themes and patterns were noted so that the findings could be developed. Findings are reported in the form of frequency counts and percentages based on emergent themes and patterns as well as direct quotes as they relate to the research questions.

For this research a follow up survey was part of the member checking process. This survey was developed in response to the ISTE NETS-T findings and to confirm and further explain findings from other qualitative data sources. It was given at the end of the research cycle as a follow up after all the data analysis

was nearing completion. The survey was sent electronically to teachers via a Google form.

**Data validity.** Data validity was checked for both quantitative and qualitative data sets. With respect to the quantitative data, the t-test had a significance score for the pre and post results. In consideration for using the actual survey instrument, a Cronbach Alpha test was performed on ISTE NETS-T using PASW to ensure there was a high level of reliability between the items representing the different constructs in each section.

With regard to the qualitative data, verifying convergence with other data and member checking were the primary tests for validity. Convergence with other data sources refers to comparison of results through triangulation and complementarity as well as references from the literature.

As a final step in the data analysis, findings were validated through a member check process. During the member check, the high level findings were taken back to the participants where they were asked if the researcher's interpretation of the information represented their perspective of the innovation (Ratcliff, 1995). For this research, member checking occurred during a TCT meeting after the research cycle had ended. This researcher posted slides of the data and the participants were asked if they agreed with the findings and if the interpretation of the direct quotes seemed accurate. During the member checking process, confirmation of findings and areas of disagreement were in the form of researcher's notes and discussed with each participant, and findings were adjusted accordingly.

## Chapter Four: Findings

### Research Question #1: In What Ways Did Participating in the TCT Project Influence Teaching Practices?

**How have TCT teachers used their new learning?** The data from the Google Site, the individual teacher websites, a follow up survey, and meeting notes demonstrate through examples and comments how TCT teachers are using technology resources shared during TCT time with their students. In the follow up survey teachers were asked to complete the sentence: ‘I have used the following with my students...’ Topics covered as part of the TCT group were listed as options. As demonstrated in Table 5, two examples in particular stand out: the use of Podcasting and the program Glogster. Where teachers reported on the survey using all the tools, the only evidence of student projects included Podcasting and Glogster. These were the two tools emphasized anecdotally in the qualitative data as well.

Table 5

*Follow Up Survey Results of Technology Tools Used with Students N=8*

	Percentage of Responses Related to Using the Tool
Podcasting	100%
Glogster	75%
Using Powerpoint to Organize Your Day	37%
Prezi	25%

**Podcasting.** Recall from Chapter 3, two meetings were dedicated to aspects of podcasting and the recording tool Audacity. Three of the teachers reported using podcasting multiple times in their classroom and posting student work on their own individual teacher websites. One of the teachers asked students to read books and then write and record book reviews. This particular teacher indicated that students felt a sense of importance as other students in the school could listen to the reviews. The other teacher, in a primary classroom, posted an example of a podcast of her students reading in chorus to improve fluency. The third teacher presented her use of podcasting during one of the virtual meetings; calling it Multiplication Poetry. The activity involves students rapping or singing a multiplication facts song to the song or beat of their choice.

**Glogster.** Glogster was another technology resource explored by the group. As indicated in Chapter 3, one meeting was dedicated to using Glogster. Seventy-five percent of the teachers reported using Glogster with their students. Two of the teachers posted evidence of using Glogster for specific lessons. One teacher's Glog was featured on the district website. She utilized this tool with first grade students as part of a personal narrative writing assignment. The students made Glogs based on their writing. It featured favorite foods, family, and interests. A junior high teacher featured his Glog through a school blog post. For his project students used a simulator to design a roller coaster. They then built their simulated designs and used the webcams on their netbooks to record the process. Their Glogs were the culminating assignment, bringing together the entire process and the findings into an interactive poster design.

**How has the TCT group influenced the TCT teachers' practice and the practice of others?** Teachers were asked two questions directly related to practice in the focus group session held at the end of this research cycle: 1. How has your participation in this group, helped your own practice or changed your instruction? and 2. Do you feel that by being in the group you have helped influence the practice of other teachers? The focus group data was based on self-reports from the participants.

Recall from chapter three, the TCT teachers were encouraged to be become a resource on campus for technology mentoring, leadership, and minor technical support. As part of this role, the TCT was charged with planning and delivering instruction for two district-wide educational technology training days. One of these training days was executed during this research project.

The focus group data supports the notion that TCT group participation influenced the practice of the participating teachers in the areas of increased confidence, new ideas, and increased skill. In the area of increased confidence, 7% of the focus group comments addressed this area. All of the comments related to confidence encompassing the idea of teaching and helping others. The TCT teachers discussed how teaching others helped them in their own learning and confidence. They also expressed how they felt their participation and knowledge sharing influenced the practice of other teachers on the campuses. One of the participants stated:

I think, teaching people about technology helps me understand how to use technology better in my classroom. It gives me that confidence that I

wouldn't otherwise have. When I have to explain it to someone else; I feel like I have confidence to use it on my own.

In the area of new ideas, 9% of the comments were related to this notion.

The participants seemed to feel that even though not all of the learning taken from their participation was immediately applicable to their classroom, the information itself was valuable as a springboard for new ideas or future application. One participant commented,

We explore a lot of different tricks in these meetings and I've been able to take them back and see how they fit in my own classroom. After the meeting where we went over Glogs, I gave it to my students and a few days later we incorporated it into what we were doing.

Another participant had a similar comment, "I modeled a PPT (Power Point) after participant 1's PPT. Even if I don't use it every day, it's really nice to have this tool. "

As part of the focus group and directly related to this, teachers were asked about how their participation in the TCT group affected the practice of other teachers. There was overall agreement that they influenced other teachers on their campuses. Forty-one percent of the participants responded to this question. The overall theme was related to the fact that teachers were more comfortable going to other teachers for assistance with technology in their classroom. One participant stated,

I think it's definitely helped teachers feel comfortable with saying, 'I don't know how to do this.' I get teachers that come up to me and say, 'I'll ask

you, and I don't have to admit to my principal that I don't know how to do this, it won't get out.' I'm getting a lot more teachers calling me and asking, 'I know this is really basic, but I don't know how to do this.'

Another participant had a similar comment, "Someone told me today she was a technology dinosaur and that she felt really comfortable talking to me and that I was her 'go to' girl."

**To what extent do the TCT teachers participate in activities related to educational technology?** As part of this project, the TCT Teachers were asked to log their time in the areas of mentoring, tech support, team teaching, and using technology in their classroom. The TCT Teachers reported 117 hours of mentoring, 105 hours of providing technical support, 26 hours of team teaching, and 25 hours of using technology in their classroom over four months. Four of the teachers did not break down their classroom use of technology; rather, they made a note indicating they found technology such an integral part of their daily practice that they were unable to accurately relay the hours in categories. TCT teachers collectively made 245 entries to the log related to mentoring. Forty-two of the entries were directly related to how the learning shared during TCT collaboration time influenced their practice or practice of other teachers.

Overall, the TCT teachers reported the learning shared during TCT time did have an influence on their teaching practice. Artifacts from student projects provided evidence of this finding. Teachers did not all use new learning from the TCT sharing time at the same levels, however. Green group members, teachers with the highest access to technology for both themselves and their students,



discussed projects that demonstrated student produced examples that occurred over multiple days involving both student and teacher centered technology use. . Teachers from the yellow group reported using the new learning. However, they did not share student examples of work. Teachers were encouraged to share out student work samples during the meetings, and they were invited and prompted to share student work samples on the Google Site. Based on an absence of student work examples from the teachers in the 'yellow group,' it is assumed they tried out the new learning as they indicated, but in a teacher centered way.

### **Research Question #2: What Was the Effect on Teachers' Technology Skills After Participating in the TCT Group?**

Response to this question was first based on the ISTE NETS-T assessment. Then, the data from the online Elluminate meetings, the Google Site, Teacher Websites, the Focus Group and the TCT Teacher Logs were triangulated to further answer this question.

The ISTE NETS-T assessment was utilized in a pre and post fashion. Utilizing data collected from the pre-survey, a Cronbach's Alpha test was performed on the four main constructs of the Assessment. The results of this assessment were utilized to determine consistency among the items. For the social sciences, a reliability coefficient of .70 or higher is considered acceptable (Gliem & Gliem, 2003). For each of the constructs in this assessment with at least 4 items, the Cronbach's Alpha was greater than .70 respectively (see Table 6). The fourth construct had only two items and had a Cronbach's Alpha score that is well below the accepted reliability measure. This result may be partly due

to the low number of items. Typically when using Cronbach's Alpha as a measure for interrelatedness, as the number of items increases, the opportunity for a higher score increases.

Table 6

*Cronbach's Alpha Score – ISTE NETS-T Survey N=11*

Constructs	Cronbach's Alpha	Number of Items
1. Facilitate and Inspire Student Learning and Creativity	0.737	4
2. Design and Develop Digital Age Learning Experiences and Assessments	0.858	4
3. Model Digital-Age Work and Learning	0.913	4
4. My Work Environment	0.209	2

The results from the ISTE NETS-T survey (see Table 7) demonstrated unanticipated results as the mean scores on the post survey were lower than the pre survey for every construct except Construct 4, My Work Environment. The standard deviation in all instances was consistent, indicating little variation in the data values as compared to the mean.

A t-test was performed on the data to determine if there was a significant difference between the mean scores. According to a .05 level of significance, the results demonstrated by Table 6 indicate that there is not sufficient evidence to assume participation in the TCT project had a negative or positive influence on

the TCT teachers' technology skills as measured by the ISTE NETS-T Assessment. In all instances the t score was higher than the difference between the means and in all cases the level of significance was not below .05.

Table 7

*Comparison of Pre and Post Means for ISTE NETS-T Survey*

	Pretest <i>M</i>	Posttest <i>M</i>	<i>SD</i>	<i>t</i>
Construct 1: Facilitate and Inspire Student Learning and Creativity	3.18	3.11	0.516	0.292
Construct 2: Design and Develop Digital-Age Learning Experiences and Assessments	3.11	3.00	0.716	0.316
Construct 3: Model Digital-Age Work and Learning	3.20	3.20	0.516	0.729
Construct 4: My Work Environment	2.30	2.54	0.367	-2.185
Overall Survey	2.95	2.90		

Due to the lower scores on the post survey, the TCT teachers took an anonymous follow-up survey. The survey contained one open-ended question related to these results. In the survey, they were asked why they felt thought minimal growth was demonstrated between the pre and post survey. Eight of the nine teachers responded. An analysis of the responses revealed an overall theme of less confidence in light of more knowledge. The teachers reported that their participation and increased exposure to the potential use of technology in the

classroom made them realize they felt like they knew less than they had originally thought. To illustrate this one participant responded, “I think it's because we became more aware of potential uses of technology integration and realized that there's so much more we need to learn.” Another indicated that possibly people were somewhat overconfident at the beginning. “People may have questioned themselves more after finding out how much they 'didn't' know.”

In spite of the unexpected survey results, the qualitative data demonstrated the technology skills of the TCT teachers increased. Overall, there was a sense that the teachers’ own understanding and confidence increased by virtue of their roles as a technology leader and by assisting their colleagues. One teacher indicated that by learning new tricks in the meetings, she felt she had more ideas for integrating technology in her classroom. In the follow-up survey another of the teachers commented she was not aware she rated herself lower on the post survey as she felt like she had learned a great deal and had become more confident in many areas. Increased skills were also demonstrated by looking at the number of technical issues experienced in the first virtual meeting as compared to the second. During the first virtual meeting 21% of the exchanges in the chat window or verbal comments were related to technical problems, while only 10% of the total chat and verbal exchanges were of a technical nature during the second meeting.

With regard to examples of actual use of technology that demonstrated increased skill, the TCT teachers were provided new hardware as part of their participation in the project. When teachers were given the iPod in particular, the

majority of the teachers were not familiar with the functionality of the device and none of them had demonstrated evidence of podcasting experience before. As a result of participation in the TCT group, as indicated in Table 4, podcasting was used by 100% of the TCT teachers in some capacity.

TCT teachers interested in sharing a topic of their choice during the virtual meeting time, signed up for a particular meeting date and planned and delivered a lesson on their proposed topic. Responses to those shareouts were overwhelmingly positive with 18% of the comments from the total data set being related to support talk for the idea or lesson. Field notes indicate that three of the teachers have implemented some learning from the virtual meetings in their classrooms in a successful way. This suggests the new learning positively affected the teachers' skill levels enough to implement the new idea in their classroom.

Contrary to the majority of the findings, there is evidence some teachers were overwhelmed by their participation in the TCT group. At least three participants felt like the pacing was too fast. As a consequence they felt overwhelmed by the information and the pressure to implement the new ideas in their classroom. Recall from Chapter three that after the first cycle of action research, the TCT group membership changed slightly and three new members were added. All three of these participants expressed frustration with being new members to the group in August. This indicates more differentiation may have been necessary for the new members to affect their skill levels more positively and that the skill levels of the group members were influenced at different levels.

Overall, the quantitative data produced unexpected results in that the mean scores of the teachers for the teachers were lower on the post assessment. To support the complementary analysis (Greene et al., 1989) of the findings, a follow-up survey of the TCT teachers seems to demonstrate that although the teachers learned new technology skills, they felt less confident about their knowledge on the post assessment. Examination of the qualitative evidence however, seems to demonstrate the technology skills of the TCT teachers has increased as a result of their participation in the group. This was demonstrated by evidence of TCT teachers applying the new learning in their classrooms as well as their own ability to interact with the new technology introduced to them as part of the TCT team.

**Research Question #3: What Factors Support or Inhibit Online Interaction of the TCT Between the Regular Face to Face Meeting Times?**

Upon examination of the Google Site activity, the data demonstrates that teachers did not directly post to the Google site with frequency. Of the sixty three total postings, fifty seven were made by the community coordinators and six were made by the TCT teachers. To further explain this finding the TCT teachers were asked what they liked and disliked about the Google Site. During the focus group, the teachers expressed that they felt that working in the Google environment was slow and they expressed what they referred to as “Google Overload.” They indicated they use Google across the district for many tasks and that there was still some confusion about how to work with the Google tools. One participant said, “I feel like I’m on Google overload! I get confused. We use Google for our

curriculum maps, Google for technology, I’m still trying to get use to what I’m attached too... what I can view...” They were also asked why they had not posted much independently to the TCT Google Site in particular. The main concerns voiced were a lack of time and a sense of intimidation. One of the comments was, “When I feel like the entire district is going to see it, I get nervous and can’t post.”

While it appears collaboration via the Google Site was minimal, collaboration between TCT members occurred via other means. The exit surveys administered after each meeting specifically asked about the level of collaboration between TCT members. According to Table 8, 51.3% of TCT teachers reported communicating with other TCT teachers on a weekly basis or more frequently.

Table 8

*Frequency of Collaboration between TCT Teachers*

Level of Frequency	Percentage of Responses
Every Couple of Weeks on Average	48%
Weekly on Average	37%
Two to Three Times a Week on Average	8.6%
Almost Daily	5.7%

Focus group data corroborates these findings and demonstrates teachers also share via other social networking sites. One member commented, “We all

use Face Book, Twitter. When we see something cool we post it and we see it.”

The group confirmed this comment in unison.

When asked about Elluminate as a collaborative learning tool, comments from the focus group demonstrated that the group felt there was promise around this tool. They reported liking the idea of being able to access and review content from prior meetings. However, there was also a sense of frustration with the tool. One member indicated he felt it was not the best use of time because so much time had to be spent resolving technical issues. The focus group data confirms this notion in that 34% of the meeting utterances and chat transcript communications were related to technical issues revolving around navigating the virtual meetings. The level of technical issues did reduce from the first meeting (106 exchanges) to the second (50 exchanges).

In conclusion, the TCT teachers report regular collaboration. The Google Site for this project was not their preferred forum for sharing. The Google environment seemed to be cumbersome and due to the public nature of it, intimidating. They did report on using social networking resources between meetings such as Facebook. The other online tool of the group, Elluminate, has posed some challenges for the TCT teachers. However, they like the idea that they can go back and review past sessions. Even though they report it is frustrating from a technical perspective, the number of technical incidents from the first meeting to the second reduced considerably. So, there is still potential promise for this tool as the group becomes more versed with working with it.



**Research Question #4: What Are the Indicators that a Technology Based CoP is Likely to Continue to Develop Once District Involvement Ends?**

By the end of this cycle of action research, collaboration and trust were demonstrated by the data in the exit surveys where TCT members were asked to respond to a prompt, ‘Collaboration with other TCT members feels...’ Table 9 depicts the majority of the responses were positive. Seventy-six percent indicated ‘good’ or ‘amazing and inspirational. Only twenty-two percent indicated ‘sometimes easy and sometimes difficult.’ Nobody chose ‘difficult and awkward.’

Table 9

*Collaboration with other TCT members feels...*

Responses	Percentage of Responses
Amazing and Inspirational	25%
Good	51%
Sometimes Easy and Sometimes Difficult	22%
Difficult and Awkward	0%

Meeting notes reinforce a sense of trust and healthy community through the documentation of teachers openly interrupting each other to share ideas. In a recent presentation on Prezi, a middle school teacher interrupted to say she learned about this tool because her students started using it for their presentations. An elementary school teacher followed up by saying she thought it would be a possible tool for her students to use for collaboration with some other students

from Maine. A side bar then occurred when she was prompted to elaborate on the Maine project. Trust was also demonstrated during the focus group when teachers demonstrated they were not afraid to admit they lacked skills in some areas and by offering suggestions to make the meetings more productive and more helpful. One participant stated, "I don't know if it's just me being new, but I feel like a deer in headlights every time I come in here." Another teacher offered the suggestion, "...we should try something that's more grade related after we get something new. I would like to work with someone else in the 1<sup>st</sup> or 2<sup>nd</sup> grade."

TCT teachers seeking out each other for help and interacting with each other outside of meeting times was demonstrated. During the virtual meetings 38% of the interactions were related to TCT teachers soliciting technical support from each other related to the virtual meeting format or offering technical help as related to the meeting content. Twenty-five percent of the virtual meeting time was spent on 'on-topic knowledge sharing.' Meeting notes also demonstrate that the teachers' initial conversation starters with other TCT teachers prior to the start of a meeting were often related to sharing a technology idea or inquiring about how they may implement some technology. An example of one of these exchanges was, "Did you add music to your book reviews or do you just have the kids record their voices?" Another teacher sat down and immediately said, "I found the coolest SmartBoard lesson the other day..." These quick technology exchanges are common prior to the start of a meeting and teachers seem to demonstrate an overall enthusiasm about interacting with their TCT colleagues.

With regard to frequency of interaction, recall from Table 8, the exit survey data showed 51.3% of the TCT Teachers indicated they collaborate with other TCT members at least weekly on average outside of the scheduled meeting times. In the focus group, they revealed many of them are on social networking sites such as Facebook and Twitter and that they often post ideas via these formats.

With respect to coordination and synergy, TCT members were asked how they would rate the overall feeling of community among the TCT group. As indicated by Table 10, the majority provided a positive rating with 45.7% indicating 'excellent' and 42.9 choosing 'good.' 11.4% marked 'average.'

Table 10

*How would you rate the overall feeling of community among the TCT group?*

Responses	Percentage of Responses
Excellent	45.7%
Good	42.8%
Average	11.4%
Fair	0%
Poor	0%
Can't tell yet	0%

When put in the position of planning together, the group demonstrated excellent synergy. This was demonstrated in the coordination of the district Technology PLC Day. Recall, this was a day that was set aside for all district

teachers to sign up for a class offered by the TCT Teachers. In order for this event to come to fruition, TCT teachers discussed the offerings, created course descriptions, signed up to teach a class individually or with a partner, resolved redundant offerings, reserved their own spaces, and created their own materials. If this synergy had not existed, the district-wide professional development endeavor could have potentially had a host of organizational issues. This researcher provided the TCT teachers with time and the Technology Mentor Teacher helped guide the group as to considerations to be aware of. However, they worked as a community to work out all of the details. The event was executed and the overall responses by district teachers that attended the training were overwhelmingly positive as demonstrated by the district professional development survey, which was administered to all attendees after any district or school sponsored training.

In the area of value added, each meeting TCT member was asked to rate the content of each meeting. The collective data demonstrated in Table 11, shows 94.3% of the teachers indicated the content was excellent or good. Only 5.7% gave content a fair rating, indicating in general the teachers felt the focus was on target to their needs.

Table 11

*How would you rate the overall content of this meeting?*

Responses	Percentage of Responses
Excellent	60%
Good	34%
Average	0%
Fair	6%
Poor	0%

The focus group data reinforced these findings. TCT teachers commented on how the meeting content gave them more material to take back and try in the classroom. Teachers also spoke to how their participation in the group helped give them confidence to help others and share ideas. They also mentioned how their participation in the TCT group singled them out on their campus as being a boundary broker.

In the focus group, teachers were asked if they would continue the group if the funding were less or non-existent. The group replied affirmatively unanimously. Other indicators of group camaraderie were demonstrated in the virtual meetings with 10% of the overall exchanges being related to casual conversation.

Overall, the TCT group demonstrates characteristics of a CoP. Being this is the second year the majority of the group members are working together, when looking at the stages of a CoP, the data suggests the developmental level of potential was not fully realized. However, the group definitely showed signs of

achieving the coalescing stage in that they seem found value in participating, they demonstrate trust, and there was evidence of honesty among group members.

## **Chapter Five: Discussion**

The TCT community intervention was created to build local capacity among teachers at the school level for technology integration by providing focused training and support utilizing the theoretical framework of social learning. For this chapter a discussion of each finding organized by research question will be presented. Then, the future implications, limitations, and overall conclusions of this research study will be discussed.

### **Research Question #1: In What Ways Did Participating in the TCT Project Influence Teaching Practices?**

**Discussion.** Teachers having the support of the TCT community and learning from each other was an important aspect of this project. A reoccurring notion surfaced throughout indicating the TCT teachers' own learning and confidence was often tied to helping others. Recall from chapter three that the TCT teachers facilitated a technology training day for all district teachers. Teacher responses to the technology sessions were overwhelmingly positive. The teacher comments indicated they felt the training was relevant and they liked the delivery by their peers. For this researcher, this further reinforces the idea that teachers benefit and find increased relevance in content by being trained and mentored by other teachers. Research by Schlager and Fusco (2003) emphasize teacher CoPs are integral to sustain, nurture, and spread improvement throughout an educational system and can reverse the decontextualization and misalignment of professional development that is often experienced through training by external providers.

The TCT teachers that were members of the ‘green group’ had increased opportunities to use technology with their students, and since the technology resided in their classrooms, flexibility existed regarding when and how the technology could be used. Because the devices were mobile, students were not tethered to one area of the room either. This notion of 100% access to the appropriate technology at any given time is significant with respect to student centered examples of technology use by the TCT teachers.

### **Research Question #2: What Was the Effect on Teachers' Technology Skills After Participating in the TCT Group?**

**Discussion.** The unexpected results of the t-test findings may be explained by Edyburn (2000) in his research on using assistive technology with students that have mild disabilities. In his study he uses the term ‘paradox of assistive technology consideration.’ In the context of his research, he uses the example that a teacher cannot be expected to recommend an assistive technology if he/she does not know what is available. Similar to this concept, the TCT teachers rated themselves higher on the pre survey. Then, as they became aware of what they did not know, their self reported ratings decreased on the post survey. Responses on the follow up survey supported this notion. Overall, this seems to indicate a positive shift in the teachers’ perceptions of what they felt initially regarding technology use prior to their participation in the TCT group versus at the end of the research cycle. Perhaps this awareness can lead teachers to have a higher expectation overall of technology and learning.



There was also a disconnect in the TCT teacher training in that the ISTE NETS-T assessment measures the teachers' levels of confidence with respect to the National Technology Standards and not discrete skills. Teachers in the TCT group learned how to integrate new tools into their lessons in the context of supporting student learning of the content standards. The ISTE standards were inferred, but not discussed directly. So, the verbiage on the survey could have been confusing to some of the participants.

**Research Question #3: What Factors Support or Inhibit Online Interaction of the TCT Between the Regular Face to Face Meeting Times?**

**Discussion.** The online tools had a learning curve that was difficult to overcome, and in some cases the teachers did not fully accept them fully for communication. This speaks to the importance of participants being fluent with communications methods. Barab et al. (2001) attributed great importance to the effectiveness of the technology tool in the act of communicating, emphasizing it is important people do not feel that they are interacting with the computer, rather they are interacting through computers with each other.

Additionally, the attempt to marry formal work space and collaborative space could have been a mistake in that there was an assumption the TCT teachers felt comfortable in asserting themselves in this type of environment. In the pilot phase, the forum page of the site was used more frequently by TCT teachers because community coordinators posted questions for the teachers to respond to. During this cycle of action research the intent was to distance slightly from the question and answer type format to see if TCT teachers used the Google tools to

share or seek each other out for assistance on an as-needed, spontaneous basis. This did not occur. The research by Kreijns et al. (2003) speaks to this where they indicate it is a mistake to assume that because there is a mechanism for socializing online that socializing will occur naturally.

The TCT teachers did report they collaborate regularly via other means such as Facebook, Twitter, and email. This is an interesting finding as these social networking forums are often blocked by school districts and their use during the work day is discouraged. The district where this study occurred does not block all social networking sites. However, the use of these sites is not encouraged for professional collaboration either. Part of the issue is that districts do not have control of the content placed on third party sites. So, the institutionalized use of these sites with regard to content is often controlled. Posts are approved prior to going live and due to public record issues, it is recommended postings on third party social networking sites be a duplication of content already recorded in some reproducible format by the district. So, where a district can distance itself from individual teachers interacting on a social networking site, it is more difficult to do so if inappropriate, unprofessional, or disparaging content is posted publically and said social networking site is formally used by the district. Until leaders become more comfortable with being able to define appropriate policy and/or social networking platforms provide administrative tools for organizations to make use of the format, the integration of these platforms on a large scale may pose challenges.

#### **Research Question #4: What Are the Indicators that a Technology Based CoP is Likely to Continue to Develop Once District Involvement Ends?**

**Discussion.** CoPs are considered to be emergent, self-reproducing, evolving, and extending beyond formal structures as they creating their own norms and organizing structures (Barab & Duffy, 2000; Lave & Wenger, 1991). As this project was funded through a grant project, the TCT teacher group clearly was not self-emergent and the initial organization fit more closely with the structure of a PLC than a CoP. The notion to migrate the teachers from a PLC to a CoP was borne of an attempt to continue the learning even beyond the grant funding cycle.

This migration of a PLC to a CoP is according to Schlager and Fusco (2003) “a major objective of many professional development interventions...” This migration concept is an important factor to consider because it seems to be the more practical approach for projects and organizations that are highly structured and performance based.

This creates an alternative pathway from PLC group to CoP within the realm of education. Schools differ from businesses because teachers have limited ability for teacher-to-teacher interactions during the work day. Consequently, time for collaboration is difficult to find, and somewhat limited to before and after school or asynchronous online communications.

The notion of a PLC type structure at the beginning stages of the project provided an opportunity for the TCT teachers to build a stronger knowledge foundation. This is what also allowed the TCT teachers to become more

institutionalized at the individual campuses and at the district level. It was through the PLC structure and defined grant goals that the teachers were afforded the structured meeting time to establish an identity, bond with each other, and be encouraged to reach out for support from other TCT teachers. It was the structured, goal-oriented process that allowed for the characteristics of a CoP to develop and emerge.

### **Future Implications**

**Local implications.** As this project is being evaluated for the next cycle of action research several major changes are being evaluated. First, the use of the groups feature in FaceBook is being considered as a possible option as the primary online portal for sharing and collaboration among group members. The Google Site will still be used as a public repository for technology resources and meeting notes as it is a good public space to see the group's progress as well as a resource area for other teachers to gain ideas.

The other option being considered is a change to the model where TCT members receive common training for 50% of the meeting time. Then for the remaining meetings they will be grouped into grade level groups or content groups and sign up to train each other. It is an idea that may address some of the comments by current TCT members related to wanting to work with grade level peers. In addition, it may help to differentiate instruction more for TCT members that use technology at different levels.

**Broader implications.** This project may serve as a possible model for professional development in educational technology. The model may also be

generalized to other fields assuming the situation, needs, and context of the environment in question are similar enough to the one proposed in this research for replication to occur. This research supports the notion of building local capacity at the site level without forgetting that the local experts also need the support of their own learning community. It is important to note that the district where this research took place has the advantage of a leadership team that supports innovation and that expects collaboration. It also has the luxury of receiving a higher percentage of grant funds due to the high free and reduced lunch count and consequential federal aid. Without the support of a culture where employee collaboration is an expectation and where incentive based participation is supported, similar results may not be possible.

### **Limitations**

Bias could be a factor in this inquiry as the researcher was responsible for the grant management and overall performance of the group. However, to minimize this, the social learning aspect of the project was emphasized and the data was meant to capture primarily teacher experiences, teacher voices, and evidence of student work.

The number of participants for this study was also low and participants that were chosen for this project self-identified themselves as interested in educational technology. Because of this, results are not meant to be representative of the general teacher population. In addition, due to the nature of an intervention for action research, the results of this study are intimately linked to the setting and participants involved. Where a model or outcome may be

suggested, there is no evidence this intervention could be replicated across other domains.

### **Overall Conclusions**

Overall, the TCT project provided a starting point for a professional development model that can be continuously adapted to meet the needs of the teachers and the district. More importantly this model is based on the idea of building local capacity and a community of ongoing support that can be utilized for more district initiatives than just technology integration.

With respect to online collaboration, the findings of this project have served to create an awareness that online collaboration does not occur simply because a tool is in place. The public and private realm of this type of communication is extremely important. It is necessary to take into account the depth and type of communication one is trying to provoke when choosing an online collaboration tool. It is also important to recognize that a collaborative space is not necessarily a communicative space. In other words, collaborating on specific topics or simply sharing is different from eliciting help, asking for generalized feedback, or engaging in friendly exchanges. The Google Site for this project was demonstrated to be a good collaborative space to share meeting information, archives, and resources, but it did not work well as a communicative space. The public realm was reported to be intimidating and the tool itself, cumbersome. As a result, it was not an online tool that invited informal exchanges, requests for help or idea trading.

Regarding technology integration, access to the appropriate technology in any given moment during instruction is significant to a teacher's ability to integrate technology effectively. This is contrary to common models in K-12 where a few permanent computer labs somewhere on a campus or a mobile computer lab that can be scheduled and checked out is considered sufficient access for effective technology integration. This study has shown that possibly these models are in fact, more disruptive than integrative. For example, in the case of a lab located in another building on campus, teaching in the classroom must stop as students line up and travel to the technology tool. Mobile labs also have to be scheduled. As a result, often the teaching is timed to occur before or after the technology use. That way full advantage can be taken of the few days or hours the lab may be in the classroom. When devices are located in the classroom for anytime use, teachers can use them throughout the day as part of a lesson, and then put them away as needed. They can be left on so access is fast and login time is minimized. The teachers and students become familiar with those particular devices and common issues that may arise are managed more easily. In short, the idea of including even a large technology component into a lesson is less daunting because the work can be completed throughout the day and within the natural pacing of a lesson.

Finally, incentives and requirements are important when planning professional development that requires teachers to collaborate and plan outside of the school day. Without creating a structure that is tied to some reward for participation, it may be difficult to achieve consistent participation or

membership. If group members sense an inconsistent level of participation, the overall value is diminished.

For this research a monetary incentive as well as other hardware incentives were provided. Both incentives were provided to meet the needs of this specific project and they were developed in line with current district practices. The incentives were a motivating factor for participants and incentivizing also implied a certain level of accountability for the participants as well. Had the incentives not been in place, due to the meetings being after hours and the expectations to experiment with new learning with students, teacher participation may not have been sustainable for the duration of this research. For this project, other types of incentives such as release time or technology devices alone may have also worked to achieve full participation. However, an evaluation of the cost versus time benefit would be necessary to ensure a different incentive would have been sufficient.

The idea of a supportive community is also important. It provides an environment where teachers can connect and feel mutually supported. As demonstrated in this project, teachers like to learn from other teachers. This seems to add a greater sense of relevance and legitimacy to the overall learning.



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APPENDIX A  
RECRUITMENT SCRIPT

I am a graduate student at Arizona State University working under the direction of Dr. Puckett in the Department/Division/College of Teacher Education and Leadership at Arizona State University. I am conducting a research study to study the effect and impact of online collaboration tools on a developing community of practice.

I am recruiting members of this community to participate in four phases of research. 1. For this research I intend to administer a pre and post ISTE survey. All surveys will be coded with numbers and stored separately from the names. All results will only be reported collectively so anonymity is ensured. 2. The content posted in the online environment used by this group will be analyzed as it relates to the research questions. Names of participants will not be used and attempts will be made to report on all data collectively. If direct quotes are used from this data, pseudonyms will be used and not the name or any other identifier of the participants. 3. Respondents are also asked to participate in a 30-45 minute focus group related to the online activities and your overall perception to how the development of the community of practice has impacted your classroom instruction. Focus group sessions will be recorded. The recordings will only be maintained until the completion of the project. Names will be stored separate from recordings. All data from the recordings will be reported on collectively and if direct quotes are used, pseudonyms will be used. 4. This researcher will collect field notes and maintain a researcher's journal. Direct quotes may be noted. Pseudonyms will be used when referring to any individual participants.

Your participation in this study is voluntary. If you have any questions concerning the research study, please call me at 623-692-8194.



APPENDIX B  
CONSENT LETTER

Date

Dear \_\_\_\_\_:

I am a graduate student under the direction of Dr. Puckett in the College of Teacher Education and Leadership at Arizona State University. I am conducting a research study to study the effect and impact of online collaboration tools on a developing community of practice.

I am recruiting members of this community to participate in four phases of research. The ISTE NETS-T Survey is given to all teachers as part of the yearly district data collection for technology integration. For this research project, I intend to administer the ISTE survey prior to the beginning of this research project and at the end of the project in order to compare results. All surveys will be coded with numbers and stored separately from the names. All results will only be reported collectively so anonymity is ensured.

Participants in this study will be asked to collaborate via district approved online collaborative environments. This may include tools such as blogs, wikis, and other social networking portals. The content posted in the online environment used by this group will be analyzed as it results to the research questions. Names of participants will not be used and attempts will be made to report on all data collectively. If direct quotes are used from this data, pseudonyms will be used and not the name or any other identifier of the participant. Participants are also asked to participate in a 30-45 minute recorded focus group related to the online activities and your overall perceptions as to how the development of the community of practice has impacted your classroom instruction.

Interviews will be recorded. The recordings will only be maintained until the completion of the project. Names will be stored separate from recordings. All data from the recordings will be reported on collectively and if direct quotes are used, pseudonyms will be used. This researcher will collect field notes and maintain a researcher's journal. Direct quotes may be noted. Pseudonyms will be used when referring to any individual participants.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. Withdrawing will not effect your employment or position in any way. You must be 18 years of age to participate in this study.

This study hopes to add to the body of research on online collaboration and communities of practice in the areas of pedagogy and teacher professional development. There are no foreseeable risks or discomforts to your participation.

Your responses will be anonymous. The results of this study may be used in reports, presentations, or publications but your name will not be used. In most cases, all data will be presented in a collective manner.

The focus group session will be audio-taped as will some of the online collaboration sessions. Please let me know if you do not want to be audio-taped You can change your mind after the focus group starts. All audio-taped recordings will only be stored for the duration of this project. They will be stored in a locked cabinet and names will be stored separately.

If you have any questions concerning the research study, please contact me at 602-692-8194 or Dr. Puckett, Principal Investigator and ASU Professor at 602-543-6141. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Return of this signed letter is your consent to participate. If you do not wish to participate, please do not return this form.

I agree to participate in this research project

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Signature

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Printed Name

APPENDIX C

INTERVIEW QUESTIONS AND SCORING RUBRIC FOR TECHNOLOGY

CORE TEACHER SELECTION PROCESS

Use the rubric to rate each candidate's response. A-F is based on a standard grading scale: A=Excellent, B=Above Average, C=Average, D=Below Average, F=Fail					
How do you use technology in your personal and professional life?	A	B	C	D	F
	Comments:				
Please describe the last lesson where you used technology with students.	A	B	C	D	F
	Comments:				
What is your attitude regarding the integration of technology into the curriculum?	A	B	C	D	F
	Comments:				
Please self rate your skill level with regard to technology and explain your answer.	A	B	C	D	F
	Comments:				
How often do you share best practices and ideas with other teachers?	A	B	C	D	F
	Comments:				

APPENDIX D

NETS FOR TEACHERS SELF-ASSESSMENT 2009-2010

## Section 1. Welcome and Overview

The purpose of this self-assessment is to gauge your current level of experience in using technology in teaching and learning.

The self-assessment is divided into 5 sections, each containing between 4 and 5 multiple choice questions.

When reading each question, select your level of confidence from the 4 choices offered.

1. Please enter your name (survey results will only be reported collectively and your identity will remain anonymous. Names are used only to track your participation):
2. Please choose the school(s) where you teach. (school options here)
3. How many years have you been a classroom teacher?
4. What year were you born?

## Section 2. Facilitate and Inspire Student Learning and Creativity

4. I can use digital tools to promote, support, and model creative and innovative thinking and inventiveness.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

5. I can engage students in exploring real-world issues and solving authentic problems using digital tools and resources.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

6. I can promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

7. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this



Section 3. Design and Develop Digital-Age Learning Experiences and Assessments

8. I can design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

9. I can develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

10. I can customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

11. I can provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

#### Section 4. Model Digital-Age Work and Learning

12. I can demonstrate fluency in technology systems and the transfer of current knowledge to new technologies and situations.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

13. I can collaborate with students, peers, parents, and community members using digital tools and resources to support student success and innovation.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

14. I can communicate relevant information and ideas effectively to students, parents, and peers using a variety of digital-age media and formats.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

15. I can model and facilitate effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning.

1. Not at all
2. Minimally
3. Confidently
4. I am able to teach others how to do this

## Section 5. My Work Environment

16. I currently have a class website that I can use/update regularly to provide students and/or parents with up to date information?

1. I don't have a website currently
2. I do have a website but I rarely update it
3. I do have a website that I update occasionally
4. I do have a website that I update on a very regular basis.

17. I use some collaborative online tools with my students. Yes No If you answered yes, which tools, websites, portals do you use and why?

18. What are some of your challenges to using technology with your students?

19. Please provide any additional comments regarding your desires with respect to technology in the district.

APPENDIX E  
FIELD NOTES COLLECTION GUIDE

<b>Date:</b> <b>Time:</b> <b>Place:</b>	<b>Participants:</b>
<b>Observation Notes</b>	<b>Reflective Notes</b>

APPENDIX F  
FOCUS GROUP PROTOCOL

<b>Distribute materials</b>	Copy of the Questions
<b>Moderator introduction, thank you and purpose (1 minute)</b>	<p>Hello. My name is Julie Morgenthal. I'd like to start off by thanking each of you for taking time to come today. We'll be here for about an hour and a half.</p> <p>The reason we're here today is to discuss your experience in the Technology Core Teacher Group.</p> <p>I am going to lead our discussion today. I am not here to convince you of anything or try to sway your opinion. My job is just to ask you questions and then encourage and moderate our discussion.</p>
<b>Groundrules (2 minutes)</b>	<p>To allow our conversation to flow more freely, I'd like to go over some ground rules.</p> <ol style="list-style-type: none"> <li>1. Please talk one at a time and avoid side conversations.</li> <li>2. Everyone doesn't have to answer every single question, but I'd like to hear from each of you today as the discussion progresses.</li> <li>3. This will be an open discussion ... feel free to comment on each other's remarks.</li> <li>4. There are no "wrong answers," just different opinions. Say what is true for you, even if you're the only one who feels that way. Don't let the group sway you. But if you do change your mind, just let me know.</li> <li>5. Just let me know if you need a break.</li> </ol>
<b>General questions (20 minutes)</b>	<ol style="list-style-type: none"> <li>1. Please describe your overall feelings about being a member of the TCT group.</li> </ol>

<p><b>Specific questions</b> <b>(20 minutes)</b></p>	<ol style="list-style-type: none"> <li>2. How did your participation in the Technology Core Teacher group affect your classroom instruction?</li> <li>3. Describe your working relationship with other TCT teachers.</li> <li>4. Provide some examples as to how you used other TCT members as a professional resource.</li> <li>5. How often did you communicate with other TCT teachers in between meeting times?</li> <li>6. Do you feel like you will continue to work with the TCT group members even after this project ends. Why or why not?</li> <li>7. What were the advantages and disadvantages of using the online components (Google and Elluminate)?</li> <li>8. Do you have anything to add regarding your experience in the Technology Core Teacher project?</li> </ol>
<p><b>Closing</b> <b>(2 minutes)</b></p>	<p>Thanks for coming today and talking about early your experience as a Technology Core Teacher. Your comments have given me insight with respect to technology and learning. I thank you for your time.</p>



APPENDIX G  
INSTITUTIONAL REVIEW BOARD APPROVAL

**To:** Kathleen Puckett  
FAB

**From:** Mark Roosa, Chair  
Soc Beh IRB

**Date:** 01/11/2010

**Committee Action:** Exemption Granted

**IRB Action Date:** 01/11/2010

**IRB Protocol #:** 0912004662

**Study Title:** Effects and Implications of Online Collaboration on Developing a Community of Practice

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(1) (2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.